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Earth Resources
A Continuing
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ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following ranges.

STAR (N-10000 Series)	N86-16186 – N86-22536
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NASA SP-7041(50)

EARTH RESOURCES

A CONTINUING BIBLIOGRAPHY WITH INDEXES

Issue 50

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between April 1 and June 30, 1986 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

NASA Scientific and Technical Information Branch 1986
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TYPICAL REPORT CITATION AND ABSTRACT

NASA SPONSORED

ON MICROFICHE

ACCESSION NUMBER → **N86-12740*#** Kansas Univ. Center for Research, Inc., Lawrence. ← CORPORATE SOURCE
Remote Sensing Lab.

TITLE → **EVALUATION OF SPACE SAR AS A LAND-COVER CLASSIFICATION Final Report**

AUTHORS → B. BRISCO, F. T. ULABY, and T. H. L. WILLIAMS 1985 ← 123 p ← PUBLICATION DATE
refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198
ERTS

CONTRACT NUMBER → (Contract NCC9-7)
(E86-10004; NASA-CR-176267; NAS 1.26:176267; RSL-TR-605-1) ← REPORT NUMBERS

AVAILABILITY SOURCE → Avail: NTIS HC A06/MF A01 CSCL 02B ← COSATI CODE

The multidimensional approach to the mapping of land cover, crops, and forests is reported. Dimensionality is achieved by using data from sensors such as LANDSAT to augment Seasat and Shuttle Image Radar (SIR) data, using different image features such as tone and texture, and acquiring multidate data. Seasat, Shuttle Imaging Radar (SIR-A), and LANDSAT data are used both individually and in combination to map land cover in Oklahoma. The results indicates that radar is the best single sensor (72% accuracy) and produces the best sensor combination (97.5% accuracy) for discriminating among five land cover categories. Multidate Seasat data and a single data of LANDSAT coverage are then used in a crop classification study of western Kansas. The highest accuracy for a single channel is achieved using a Seasat scene, which produces a classification accuracy of 67%. Classification accuracy increases to approximately 75% when either a multidate Seasat combination or LANDSAT data in a multisensor combination is used. The tonal and textural elements of SIR-A data are then used both alone and in combination to classify forests into five categories. Author

TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

NASA SPONSORED

ON MICROFICHE

ACCESSION NUMBER → **A86-15606*#** National Aeronautics and Space Administration, Washington, D.C.

TITLE → **BIOGEOCHEMICAL CYCLING IN TERRESTRIAL ECOSYSTEMS - MODELING, MEASUREMENT, AND REMOTE SENSING**

AUTHORS → D. L. PETERSON, P. A. MATSON, J. G. LAWLESS (NASA, Ames Research Center, Moffett Field, CA), J. D. ABER (Wisconsin, University, Madison), P. M. VITOUSEK (Stanford University, CA) ← AUTHOR'S AFFILIATION
et al. IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 13 p. refs ← MEETING ← MEETING DATE

REPORT NUMBER → (IAF PAPER 85-14)

The use of modeling, remote sensing, and measurements to characterize the pathways and to measure the rate of biogeochemical cycling in forest ecosystems is described. The application of the process-level model to predict processes in intact forests and ecosystems response to disturbance is examined. The selection of research areas from contrasting climate regimes and sites having a fertility gradient in that regime is discussed, and the sites studied are listed. The use of remote sensing in determining leaf area index and canopy biochemistry is analyzed. Nitrous oxide emission is investigated by using a gas measurement instrument. Future research projects, which include studying the influence of changes on nutrient cycling in ecosystems and the effect of pollutants on the ecosystems, are discussed. I.F.

EARTH RESOURCES

A Continuing Bibliography (Issue 50)

JULY 1986

01

AGRICULTURE AND FORESTRY

Includes crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventry, forest fire detection, and wildlife migration patterns.

A86-19477
REVIEW OF MODELS AND MEASUREMENTS OF MULTISPECTRAL REFLECTANCE BY PLANT CANOPIES - RECOMMENDATIONS FOR FUTURE RESEARCH
N. J. J. BUNNIK (Nationaal Lucht- en Ruimtevaartlaboratorium, Amsterdam, Netherlands) IN: Remote sensing; Proceedings of the Meeting, Arlington, VA, May 1, 2, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 2-11. refs

Different vegetation canopy reflectance models have been reviewed. Several models based on the one-dimensional radiative transfer equation developed by Kubelka and Munk (1931) are discussed with respect to their suitability for remote sensing applications. Another class of models based on radiative transfer within a finite number of uniform layers has been treated as well. Out of numerous results obtained from canopy reflectance measurements, examples are given concerning cause-effect relationships, non-Lambertian reflectance, model verification, crop yield estimation and the assessment of the influence of the atmosphere and the observation geometry. Recommendations for future research are discussed, which are dealing with crop growth monitoring, model inversion and application of atmospheric correction models. The effect of the polarization of scattered radiation should be also investigated in relation to the increased interest in data acquisition under varying view angles. Author

A86-19482* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HIGH SPECTRAL RESOLUTION REMOTE SENSING OF THE LAND
A. F. H. GOETZ (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Remote sensing; Proceedings of the Meeting, Arlington, VA, May 1, 2, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 56-68. NASA-supported research. refs

Spectral remote sensing has been practiced on a large scale since the launch of Landsat 1 in 1972. The limited information contained in this spectrally undersampled data set has led to the development of sophisticated statistical-inferential methods for data analysis. The results are usually limited by the availability of ground truth information. Recent technological developments have made it feasible to create narrow-band, contiguous, spectral image data sets that make possible the identification of surface cover materials based on the complete reflectance spectrum for each picture element. This capability will revolutionize the use of remote sensing data and require new deterministic image processing techniques to extract the full information content from the data. Sensors, based on the concept of imaging spectrometry and the new technology of area array infrared detectors, have been constructed and are candidates for Shuttle and space platform flights. Author

A86-19518
OPERATIONAL METEOROLOGICAL SATELLITE PRODUCTS FOR AGRICULTURAL MONITORING
J. D. TAPPLEY (NOAA, Satellite Applications Laboratory, Washington, DC) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 222-230. refs

A project is underway at the National Environmental Satellite, Data, and Information Service to develop products derived from satellite data that will be useful to USDA for agricultural monitoring. The products fall into two categories: meteorological observations and direct observations of vegetation. The meteorological-type measurements are to supplement conventional ground-based weather observations from data sparse areas of the world. These include estimation of precipitation, maximum/minimum temperature, solar radiation, and snowcover. The algorithms to retrieve these quantities were developed to work from operationally available data and designed to be implemented in a near real-time operation. Direct observations of vegetation are interpreted by means of indexes consisting of mathematical combinations of observations in visible and near infrared bands. This paper briefly describes the algorithms used to estimate these quantities from operational data, discusses the expected accuracy of the products and reviews current problems. Author

A86-19519
CROPCAST - A REVIEW OF AN EXISTING REMOTE SENSOR-BASED AGRICULTURAL INFORMATION SYSTEM WITH A VIEW TOWARD FUTURE REMOTE SENSOR APPLICATIONS
E. S. MERRITT, L. HEITKEMPER, and K. MARCUS (Earth Satellite Corp., Chevy Chase, MD) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 231-237.

A86-19520
GLOBAL CROP MONITORING - AN INTEGRATED APPROACH
R. S. AMBROZIAK (NOAA, Climate Impact Assessment Div., Washington, DC) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 238-244.

An integrated climate impact monitoring system was developed using all available data sources including satellite data; in particular the NOAA AVHRR was used as a crop monitor. The project began with the basic premises of image interpretation and introduced the simplest and most widely accepted procedures into an existing operational process, with the aim of improving the accuracy and timeliness of the impact assessment reports without a large increase in resources. An integrated man/computer approach was used for the image analysis, pattern recognition, and data processing. B.J.

A86-19521* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MICROWAVE REMOTE SENSING OF SOIL MOISTURE

T. J. SCHMUGGE (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 249-257. Previously announced in STAR as N85-23235. refs

Because of the large contrast between the dielectric constant of liquid water and that of dry soil at microwave wavelength, there is a strong dependence of the thermal emission and radar backscatter from the soil on its moisture content. This dependence provides a means for the remote sensing of the moisture content in a surface layer approximately 5 cm thick. The feasibility of these techniques is demonstrated from field, aircraft and spacecraft platforms. The soil texture, surface roughness, and vegetative cover affect the sensitivity of the microwave response to moisture variations with vegetation being the most important. It serves as an attenuating layer which can totally obscure the surface. Research indicates that it is possible to obtain five or more levels of moisture discrimination and that a mature corn crop is the limiting vegetation situation. Author

A86-19522

ESTIMATING MOISTURE CONDITIONS FOR AVHRR DATA

J. C. PRICE (USDA, Agricultural Research Service Hydrology Laboratory, Beltsville, MD) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 258-265. refs

Data sets collected through the Statistical Reporting Service of the USDA are used in an initial effort to test the utility of NOAA Advanced Very High Resolution Radiometer (AVHRR) data for soil moisture and crop yield assessment. The problem of verification of AVHRR data is chiefly one of spatial scale: the 1100-m scale of AVHRR data falls at the geometric mean of the scale of weather observations (hundreds of kilometers) and that of typical experimental ground truth (tens of meters). The physical and statistical formulations are discussed for dealing with the complex data sets, and the framework of a hypothetical operational system is addressed. The observing system of choice combines daily AVHRR passes with the infrequent but high spatial resolution data from Landsat or SPOT sensors. D.H.

A86-20660*# National Aeronautics and Space Administration. Earth Resources Lab., Bay St. Louis, Miss.

SPATIAL VARIATION ANALYSES OF THEMATIC MAPPER DATA FOR THE IDENTIFICATION OF LINEAR FEATURES IN AGRICULTURAL LANDSCAPES

R. E. PELLETIER (NASA, Earth Resources Laboratory, Bay St. Louis, MS) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 62-68. refs

A need exists for digitized information pertaining to linear features such as roads, streams, water bodies and agricultural field boundaries as component parts of a data base. For many areas where this data may not yet exist or is in need of updating, these features may be extracted from remotely sensed digital data. This paper examines two approaches for identifying linear features, one utilizing raw data and the other classified data. Each approach uses a series of data enhancement procedures including derivation of standard deviation values, principal component analysis and filtering procedures using a high-pass window matrix. Just as certain bands better classify different land covers, so too do these bands exhibit high spectral contrast by which boundaries between land covers can be delineated. A few applications for this kind of data are briefly discussed, including its potential in a Universal Soil Loss Equation Model. Author

A86-20661

GIS FOR SOILS AND RANGELAND MANAGEMENT

R. G. BEST and F. C WESTIN (South Dakota State University, Brookings) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 70-74. refs

Large areas of rangeland that are being cultivated may be susceptible to soil erosion. These areas require extensive management in order to preserve the soil resource. Conventional field survey techniques for identifying and monitoring problem areas are not adequate or cost efficient. This investigation demonstrates how a computerized geographic information system (GIS) can be used in an operational soils and rangeland management program. A composite map of landuse (interpreted from Landsat imagery), soil capability class and slope was produced with the Area Resource Analysis System, a cellular GIS. Cultivated areas on capability classes V-VIII and/or slopes greater than 6 percent were identified as problem areas. In this pilot project area, more than 60 percent of the cultivated land (3922 hectares) was on soils not suited for cultivation. The GIS was also used to produce maps useful for formulating a management plan. Author

A86-20675

APPLICATION OF GEOGRAPHIC INFORMATION SYSTEM TO MANAGEMENT OF THE PENN STATE UNIVERSITY EXPERIMENTAL FOREST

W. L. MYERS and J. J. KOLENIK (Pennsylvania State University, University Park) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 174-182. refs

Management of field research facilities requires storage, retrieval, and analysis of a wide variety of information structures with much of the data being of a locational nature. A georeferenced information system can be of considerable utility in this context if some special constraints are met. A suitable system has been developed at Penn State University and is being applied to management of an experimental forest. Author

A86-20679* Oregon State Univ., Corvallis.

SEGMENTATION OF COMPUTER-CLASSIFIED LANDSAT MULTISPECTRAL SCANNER DATA INTO SPATIALLY-CONNECTED REGIONS OF ELK HABITAT COMPONENTS

R. MURRAY (Oregon State University, Corvallis) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 208-212. Research supported by Oregon State University and Oregon Department of Fish and Wildlife. refs

(Contract NGL-38-002-053)

Segmentation of computer-classified Landsat multispectral data into spatially-connected regions of ground cover is described. Sorting and hash addressing, techniques commonly used for ordering and searching data records keyed by attributes, are the basis for the region identification and extraction. An example based on the use of spatial regions for evaluating elk habitat components is outlined. Author

A86-21127#

THE ROLE OF LANDSAT DATA IN IMPROVING U.S. CROP STATISTICS

M. L. HOLKO and R. S. SIGMAN (USDA, Statistical Reporting Service, Washington, DC) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 307-320. refs

Landsat data are used in two ways to improve U.S. crop statistics. Landsat color-composite images are used to stratify areas of land with regard to land use. This stratification is used as a technique to improve the efficiency of an area sampling frame. Also, Landsat digital data are classified and the classified results are used as supplementary information to an agricultural survey. The combination of Landsat classification results and survey data improves the precision of the estimates made. Author

A86-21128#

AGRICULTURAL STATISTICS AND REMOTE SENSING - FRENCH RESEARCH AND STUDIES WITH LANDSAT MSS AND SPOT SIMULATIONS

J. MEYER-ROUX, PH. FOURNIER (Ministere de l'Agriculture, Service Central des Enquetes et Etudes Statistiques, Paris, France), A. PODAIRE, and G. SAINT (CNRS and CNES, Laboratoire d'Etudes et de Recherches en Teledetection Spatiale, Toulouse, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 321-337. refs

A study is being conducted of the possibility of incorporating remote sensing data into the existing system of agricultural statistics. An experiment in 1981 with Landsat MSS showed that good results could not be achieved for two main reasons: MSS was not well adapted to the average field size and the point sampling survey was not efficient in combination with space data. From 1981 to 1983, SPOT simulations showed that good results could be obtained for localized statistics of crops if two conditions are fulfilled: two acquisition dates are required and times of acquisition must be carefully chosen to relate to crop calendars. D.H.

A86-21129#

THE EUROPEAN COMMUNITY'S AGRICULTURAL INFORMATION SYSTEM REQUIREMENTS AND REMOTE SENSING PROSPECTS

N. ROBSON (CEC, Directorate-General for Agriculture, Brussels, Belgium) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 339-345.

The possibilities offered by remote sensing in improving the status of information on European agriculture are recognized. Present methods are reviewed and particular difficulties relating to the use of remote sensing to obtain more accurate information are discussed. The degree of enhanced accuracy which must be obtained over present methods is examined and an evaluation of the error factor presented. By reference to work which attempts to put a cost on a remote sensing satellite system for agricultural applications, the relationship with the value of errors is indicated. The paper concludes by indicating that it is only a matter of time before remote sensing becomes an integrated part of the EC Agricultural Information System. Author

A86-21130#

AGRICULTURAL STATISTICS IN DEVELOPING COUNTRIES

W. H. WIGTON (Agricultural Assessments International, Upper Marlboro, MD) and C. K. PAUL (U.S. Agency for International Development, Washington, DC) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 349-354. refs

This paper explains a successful project in agricultural statistics that helped generate data in about ten developing countries on four continents. The methodology was tailored to the conditions in Africa, Asia, South America and Central America. In each country, the problems were jointly resolved by the technical consultants of the project and the host country personnel. In some countries, the satellite photographic data were of limited use because of the resolution of the multispectral scanner (MSS) data which was the only satellite data available. For this reason, the outlook for the future is good because of the improved resolution on both the TM and SPOT. Author

A86-21142*# City Univ. of New York, N.Y.

DISCRETE-OBJECT MODELING OF REMOTELY SENSED SCENES

A. H. STRAHLER (New York, City University, NY), C. E. WOODCOCK (Boston University, MA), L. XIAOWEN (California, University, Santa Barbara), and D. L. B. JUPP (CSIRO, Div. of Water and Land Resources, Canberra, Australia) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 465-473. refs
(Contract NAG5-273; NAS9-16664; NASA ORDER L-200080)

Remotely sensed scenes can be modeled as collections of discrete, three-dimensional objects that cast shadows on a background. Approaching scenes from this perspective has led to two related lines of research. First is the geometric/optical modeling of a forest canopy, in which conifers are modeled as cones whose size and spacing vary according to functions established by field measurements. This canopy model is 'L-resolution' in nature - the objects are smaller than the resolution cells of the image and cannot be resolved individually. Second is scene modeling in which image variance is taken as a function of the relationship between the size, shape and spacing of objects and the resolution cell size of the digital image derived from the scene. This modeling is 'H-resolution' in nature - the objects in the scene are assumed to be larger than the resolution cells of the image, and thus can be individually distinguished. Both approaches illustrate the utility of the discrete-object scene model in extracting information from remotely sensed scenes. Author

A86-21143#

ROTATION OF SPECTRAL CHANNEL AXES - APPLICATION TO A RICE GROWING AREA OF WEST AFRICA

A. BERG and A. HUBAUX (CEC, Joint Research Centre, Ispra, Italy) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 475-489.

Simulated data were obtained by two flights at three-week intervals shortly before harvest, in the Mopti-Sabe region (Mali) over traditional rice fields, cultivated without control of the submersion conditions. Strong geometric distortion prevents image registration; for monotemporal data, the most satisfactory approach was found to be the 'Soil Vegetation Water' method described in the paper. It consists in rotating the three original channel axes into secondary axes going from the origin to representative points of the three objects. The vegetation channel constitutes a green biomass index, the water channel gives a map of water saturation, and the derived color composite shows details hidden in the original channels. By the use of a box classifier, a thematic map is obtained. Classification results are analyzed by confusion matrices. The method presents several advantages: simplicity, short computer time and possibility to use an interactive classifier. Author

A86-21144#

USE OF GROUND RADIOMETRY MEASUREMENTS (IN A TROPICAL RICE-GROWING ENVIRONMENT) AS A KEY TO THE INTERPRETATION OF A SECOND-GENERATION SATELLITE IMAGERY

G. M. FERRARI and J. M. GREGOIRE (CEC, Joint Research Centre, Ispra, Italy) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 491-501. refs

Under a remote-sensing-based rice production forecasting program in West Africa (the rice growing area of Tamani in Mali), radiometric measurement campaigns were performed over three years. The analysis of the measurement data in the visible and infrared regions has provided information on the influence of certain yield parameters on the spectral behavior of rice plants and led to the definition of interpretation keys for the use of second generation satellite images such as Landsat-4 and SPOT. The 1983 campaign (November and December) has allowed this work to be extended and completed in the three following domains: discrimination of the three main categories of aquatic vegetation during the phenological stages of broothing and earing; contribution of oblique data (at 45 deg) in relation to vertical data for the characterization of spectral behavior; and spatial variability of the spectral responses within a plot at a given moment in the grwoth cycle of rice plants. Author

A86-21145#

EVALUATION OF A SAR IMAGE FOR USE IN THE CLASSIFICATION OF VEGETATION COVER

B. ABEDNEGO, T. BLASER, R. CALOZ, and P. MEYLAN (Lausanne, Ecole Politechnique Federale, Switzerland) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 503-510. refs

An evaluation of numerical synthetic aperture radar (SAR) image processing procedures for classification of vegetation cover (gathered over the region of St. Aubin, Switzerland) is presented. The procedures used for data processing and interpretation and the methods applied in vegetation cover classification are described. In addition to 'pixel-by-pixel' classification, 'parcel-by-parcel' classification was carried out with the use of a preliminarily computed field boundary data file. The results show smoothed image, permitting a satisfactory classification of cereals. To discriminate between bare soil, grassland, and colza, however, textural information is necessary. I.S.

A86-21147#

SPOT-SIMULATION - AN EVALUATION FOR FOREST INVENTORY AND MAPPING PURPOSES

S. JAAKKOLA, D. ROSENHOLM, and L. ISAKSSON (Swedish University of Agricultural Sciences, Umea, Sweden) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 521-528. refs

Simulated SPOT-satellite data are being evaluated for forest inventory and mapping purposes at the Swedish University of Agricultural Sciences in co-operation with EARSeL/WG5. The material, methods, and previous simulation studies are discussed in this preliminary report. General conclusions on the methods used are: (1) SPOT-data, with high spatial resolution, will benefit from the use of multi-point instead of single-point classifiers; (2) various texture measures should be used for an improved performance in classification; and (3) forest cover type classification into four classes was successful with an overall classification accuracy of 90 percent or more. Author

A86-21148#

EFFECTIVE ESTIMATION OF AGRICULTURAL CROP HECTARAGE IN DEVELOPING COUNTRIES

N. E. G. ROLLER (Michigan, Environmental Research Institute, Ann Arbor) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 529-534.

An issue of major concern to most developing countries is the production of accurate, reliable and timely agricultural statistics. An inventory methodology is described in this paper, which when judged according to these criteria, has been shown to offer improved performance compared to traditional (field only) or remote sensing only inventories. The advantages of both of these latter approaches are retained in the improved methodology, while the disadvantages of each are largely overcome. The improved methodology uses a combined approach that consists of a double sampling estimation procedure, in which one of the samples is collected by remote sensing and the other by field methods. The estimate derived from the remote sensing sample is then 'bias-corrected' using the relationship observed between remote sensing and field only measurements collected on joint sample units. The effectiveness of the methodology is illustrated by descriptions of wheat inventory projects in Algeria and Nepal. Author

A86-21150#

DETECTION OF SUGAR CANE GROWING STAGES BY MEANS OF COMPUTER-AIDED ANALYSIS OF LANDSAT DATA

J. C. DE LA TORRE (Direccion General de Geographia, Mexico City, Mexico) and J. I. MIRANDA (Universidad Nacional Autonoma de Mexico, Villa Obregon) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 543-553. refs
(Contract CONACYT-PCECCNA-722418)

A single Landsat image was used to classify growing stages of sugar cane in the Tamazula, Mexico, region where sugar cane fields are not seeded at the same time. Three spectral vegetation indices were tested (GVI, DVT6, and TVT6) using a randomized complete block design. The height of several sugar cane plantations was recorded in a field two and threee days before the Landsat image was taken. Later, using a photomosaic (1:20,000) and topographic maps (1:50,000), a set of at least eight training fields was selected from each sugar cane stage and entered into the computer as reference data. It was found that the GVI and the DVI6 indices, both more powerful than the TVI6 index, were sufficiently sensitive to detect different stages (e.g., a newly seeded field, near-mature and mature sugar cane, etc.) of development for sugar cane fields with 100 percent ground cover. The TV index is limited to distinguishing stages of sugar cane from emergence to 1.2 m in height, unless data are atmospherically corrected for the path-radiance term. It is believed that a growing model for sugar cane can be developed from the characteristic growing stages obtained from a single image. I.S.

A86-21160#

FEASIBILITY OF USING GOES SATELLITE-DERIVED DATA TO ESTIMATE INCOMING SOLAR RADIATION IN THE PRADERA PAMPEANA, ARGENTINA

C. ESPOZ and A. BRIZUELA (Comision Nacional de Investigaciones Espaciales, Buenos Aires, Argentina) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 661-674. refs

A86-21168#

MONITORING GLOBAL VEGETATION FROM METEOROLOGIAL SATELLITE DATA

J. D. TARPLEY (NOAA, National Environmental Satellite, Data, and Information Service, Camp Springs, MD) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 773-784.

The Advanced Very High Resolution Radiometer (AVHRR) on the NOAA series polar orbiting weather satellite allows routine monitoring of global vegetation. AVHRR visible and near infrared data ae processed into a quantity called a vegetation index that is a measure of the greenness, vigor, or density of vegetation. The vegetation index values as well as the radiances from which they are calculated are mapped into global polar steregoraphic arrays. Daily vegetation index values are composited by saving the greenest value for 7 days to provide a relatively cloud free weekly product. Vegetation index maps have been produced for both hemispheres on a daily and weekly basis since April 1982. Author

A86-21169#

A COMPARISON OF LANDSAT-MSS, HCMM AND NOAA-AVHRR FEATURES FOR IDENTIFYING DOMINANT VEGETATION PATTERNS IN MEDITERRANEAN AREAS

B. LACAZE, G. DEBUSSCHE, A. KHELFA, H. MAZUREK, S. RAMBAL (CNRS, Centre d'Etudes Phytosociologiques et Ecologiques, Montpellier, France) et al. IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 787-802. refs
(Contract EURATOM-2283-83-12EDISPF)

In this study are considered multitemporal data from 3 satellite sensors in the visible and near infrared domain. Physical values (albedos) and normalized difference vegetation index are derived in view of characterizing Mediterranean-type ecosystems. Relationships between these spectral indicators and tree cover are obtained from Landsat data for 3 dominant species and proposed as a basis for a multisensor approach of vegetation monitoring. Related problems of multitemporal and multisensor intercalibration of data are discussed. Author

A86-21170#

EXPERIMENTAL STUDY OF THE POTENTIAL OF SPOT IMAGERY FOR CROP IDENTIFICATION AND MONITORING

G. GUYOT, M. VERBRUGGHE (Institut National de la Recherche Agronomique, Montfavet, France), and P. CAMPAGNE (Institut Geographique National, Saint-Mande, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 803-812. refs

A series of airborne measurements has been carried out in the south-east region of France on the Plateau de Valensole to study the potential of SPOT imagery for crop identification and monitoring. Radiometer measurements were performed from a small aircraft along one east-west axis with both nadir and oblique views. The axis crossed a sample of crops of this area: soft and hard wheat, barley, and lavender. The collected data show the utility of combining vertical and oblique measurements for crop discrimination. The correlation factor between the visible and the near-IR channels could be of use as an indicator of crop development. D.H.

A86-21175#

APPLICATIONS OF LANDSAT MSS AND TM DATA FOR AGRICULTURAL DEVELOPMENT PLANNING IN MOROCCO AND THE SOUTHERN SUDAN

T. E. BEAUMONT (Scott Wilson Kirkpatrick and Partners, Basingstoke, England) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 895-901. refs

A86-21176#

APPLICATIONS OF RADAR (SLAR GOODYEAR AND SIR-A) RADAR AND SATELLITE (LANDSAT) IMAGERY IN A GEOMORPHOLOGICAL AND SOIL SURVEY IN THE VENEZUELAN AMAZON [APPLICATIONS THEMATIQUES D'IMAGERIES RADAR (SLAR GOODYEAR ET SIR-A) ET SATELLITE (LANDSAT) DANS UN INVENTAIRE GEOMORPHO-PEDOLOGIQUE EN AMAZONIE VENEZUELIENNE]

M. POUYLLAU (CNRS, Centre d'Etudes de Geographie Tropicale, Talence, France) and P. BLANCANEAUX (Institut Francais de Recherche Scientifique pour le Developpement en Cooperation, Bondy, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 903-910. In French. refs

A86-21177#

A NEW METHOD OF INCORPORATING METEOROLOGICAL SATELLITE DATA INTO GLOBAL CROP MONITORING

R. A. AMBROZIAK (NOAA, Climate Impact Assessment Div., Washington, DC) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 921-929. refs

An inexpensive and effective method of monitoring vegetation using NOAA/AVHRR satellite data is presented as an integral part of a global crop monitoring system. The satellite monitoring subsystem increases the value of the meteorological and agronomical subsystems, but cannot stand alone as an assessment system. The satellite monitoring subsystem is based on a new color coordinate system which maximizes the information content of satellite images and minimizes the analysis time. The color coordinate system is described and compared to other systems. Author

A86-21184#

PER-FIELD CLASSIFICATION AND APPLICATION TO SPOT SIMULATED, SAR AND COMBINED SAR-MSS DATA

J. MEGIER, W. MEHL (CEC, Joint Research Centre, Ispra, Italy), and R. RUPPELT (Berlin, Technische Universitaet, West Germany) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1011-1018.

A classification method, using global statistics defined over individual fields, is proposed for discrimination and inventory of agricultural land occupation classes. It is compared with pixel by pixel classification in the case of SPOT simulated visible-IR data. It is also tested with SAR data and combinations of visible-IR data where the speckle effect is a major difficulty. The results show an improvement around 18 percent in the classification accuracy in the first case and a discrimination performance better than 90 percent for 5 agricultural categories in the second case. Author

A86-21185#

DIAGNOSIS OF FOREST RECOVERY IN EAST REGION OF KYOTO USING LANDSAT DATA

T. SENOO, E. IWANAMI, K. HOSHINO (Kyoto Prefectural University, Japan), S. TANAKA, and T. SUGIMURA (Remote Sensing Technology Center of Japan, Tokyo) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1019-1029. refs

A86-21186#

EVALUATION OF GROUND-BASED HOT-SPOT REFLECTANCE MEASUREMENTS FOR BIOMASS DETERMINATION OF AGRICULTURAL CROPS

N. J. J. BUNNIK, W. VERHOEF, R. W. DE JONGH (Nationaal Lucht- en Ruimtevaartlaboratorium, Amsterdam, Netherlands), H. W. J. VAN KASTEREN, R. H. M. E. GEERTS (Centrum voor Agrobiologisch Onderzoek, Wageningen, Netherlands) et al. IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1033-1040. refs

Canopy reflectance simulation studies have demonstrated that a simplified relation between leaf area index and reflectance exists for the hot-spot observed at a zenith angle of approximately 52 deg. Based on this principle a prototype ground-based hot-spot reflectance meter (HSM) has been developed and tested. The objective of the project is to verify the performance for nondestructive determination of biomass and growth stage development of agricultural crops under standardized conditions. During 1982 and 1983 an extensive field measurement program has been executed. Results obtained in 1983 are discussed. HSM data can be applied for biomass assessment during the vegetative phase. During the generative phase of cereals, change of biomass is detected due to the associated change of canopy color during ripening and senescence. This new ground-based instrument can be used in agricultural research and for ground truth collection in remote sensing. Author

A86-21187#

NOAA AVHRR DATA AS A TOOL FOR AGRICULTURAL MONITORING

Y. KERR, P. Y. DESCHAMPS, and G. SAINT (CNES, Toulouse, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1041-1048. CNRS-CNES-supported research. refs

NOAA/AVHRR (Advanced Very High Resolution Radiometer) data with a ground resolution of 1 km are geometrically and radiometrically processed to provide various types of users with useful output products on an every day basis. Output consist of a cloud analysis and the physical properties of the surface: reflectances in the visible, near infrared and 3.7 micron channels, brightness and vegetation indices. Preliminary results are shown over France. Thanks to the daily global coverage of the AVHRR experiment, they appear attractive for an operational survey of large areas in remote sensing applications characterized by short time evolutions. Author

A86-21188#

INVESTIGATION INTO THE MID-IR SPECTRAL BAND BEST SUITED TO MONITORING VEGETATION WATER CONTENT - PRELIMINARY RESULTS

G. GUYOT, H. JOANNES, C. PRIEUR (Institut National de la Recherche Agronomique, Montfavet, France), O. DUPONT (Sherbrooke, Universite, Canada), M. HUET (CEMAGREF, Castanet Tolosan, France) et al. IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1049-1063. refs
(Contract CNES-84; CNES-5024)

Main results are given of research attempting to determine the best spectral domains to monitor water content of plants, based on an experiment conducted on wheat and maize canopies during the growing period. Unusual weather conditions caused geometrical parameters of the canopy and plant water content to evolve simultaneously, making it difficult to analyze the influence of the separate parameters. High correlation was seen between the two SWIR bands (TM5 and TM7). The high correlation between SWIR (TM7) and visible (SPOT 2) shows the important effect of ground cover on SWIR response. Both water content and canopy geometry influenced SWIR response. D.H.

A86-21189#

CONTRIBUTION TO THE EVALUATION OF SOIL CHARACTERISTICS USING SATELLITE DATA

M. RAFFY, C. BUSQUET, and F. BECKER (Strasbourg I, Universite, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1065-1073. CNES-CNRS-supported research. refs

Two general models are proposed to obtain agrometeorological and geological parameters such as thermal inertia and evapotranspiration flux over large regions of our planet from both visible and thermal infrared data obtained from satellites. Assuming knowledge of air humidity, air temperature and wind speed at 2 m, it is possible to obtain the surface parameters from satellite data. It is supposed that there exist effective parameters for heterogeneous pixels which obey the local model and that the slab defined by the pixel has a vertical homogeneity. D.H.

A86-21192#

DETECTION OF HEAVY METAL STRESSED VEGETATION USING LANDSAT DIGITAL DATA

C. BANNINGER (Technische Universitaet und Forschungszentrum Graz, Institut fuer digitale Bildverarbeitung und Graphik, Graz, Austria) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1101-1105. refs

A pine tree stand growing in the Pyrite Belt (Rio Tinto area) of southwestern Spain displays a strong relationship between Landsat MSS canopy radiance values and high concentrations of copper, lead, and zinc in the underlying soil. Statistical analysis of the spectral and geochemical data from the pine tree stand shows a strong negative correlation between Landsat MSS bands 6 and 7 and soil copper and lead content, and a weaker, although similar relationship with respect to zinc. Less strong but good correlations are also shown by the first two principal components with respect to lead. These relationships, in conjunction with ground data, suggest that an increase in canopy exposure of low reflecting background material (pine needle litter) occurs as a consequence of a reduction in pine tree needle density associated with increased heavy metal content in the soil. Author

A86-21200#

THE APPLICABILITY OF LANDSAT IN AN EXPLORATORY SOIL SURVEY ON THE CENTRAL AFRICAN PLATEAU

R. N. MAGAI, T. WEN (Department of Agriculture, Lusaka, Zambia), R. LAURIN (Michigan, Environmental Research Institute, Ann Arbor), and S. KALYANGO (Regional Remote Sensing Facility, Nairobi, Kenya) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1207-1215. refs

An exploratory soil survey on a scale of 1:500,000 of 6 million hectares was carried out in the northwestern province of Zambia with the aid of Landsat images. Interpretation of the standard dry-season Landsat MSS scenes was followed by a four-month field checking period. The strength of this approach lies mainly in increasing the accuracy of the delineation of the mapping units and providing a better basis for making fewer but more meaningful field observation - a substantial advantage in many developing countries. D.H.

A86-21204#

ESTIMATION OF HAIL DAMAGE IN AGRICULTURAL AREAS IN ARGENTINA BY DIGITAL INTERPRETATION OF LANDSAT DATA

A. B. BRIZUELA and M. C. SERAFINI (Comision Nacional de Investigaciones Espaciales, Buenos Aires, Argentina) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1271-1281. refs

A86-21205#

DEVELOPMENT OF A SATELLITE-AIDED CROP ACREAGE ESTIMATION AND MAPPING SYSTEM FOR THE STATE OF CALIFORNIA

R. W. THOMAS, L. H. BECK, C. E. BROWN, and S. L. WALL (California, University, Berkeley) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1283-1294. refs
(Contract USDA-58-319T-2-0341X)

A study is currently underway in California to develop an operational system for Landsat-aided agricultural and land cover inventory. Data, processing, and resulting estimates and map products are to be shared between Federal and State users. Research has focused on two tasks: development of procedures for small grains mapping and acreage estimation, and development of procedures for use in yearly, statewide multiple crop inventory. Results for the two small grains digital classification procedures are presented. Methods and results for several experiments leading to the specification of a multiple crop system to be tested during 1985 are also summarized. Author

A86-21206*# Technicolor Government Services, Inc., Moffett Field, Calif.

ATMOSPHERIC EFFECTS ON THE REMOTE SENSING ESTIMATION OF FOREST LEAF AREA INDEX

M. A. SPANNER (Technicolor Government Services, Inc., Moffett Field, CA), D. L. PETERSON, R. C. WRIGLEY, D. H. CARD (NASA, Ames Research Center, Moffett Field, CA), M. J. HALL (Oregon State University, Corvallis) et al. IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1295-1308. NASA-supported research. refs

An analysis is presented of the magnitude and variability of the effect of the atmosphere on high-altitude Daedalus Airborne Thematic Mapper data. By regressing ATM radiances against ground radiances (from measurements by a helicopter-mounted Barnes Modular Multiband Radiometer), it was possible to account for atmospheric conditions and variability across a 250 km transect in Oregon to estimate coniferous forest leaf area index. The technique permitted scene contrast to be increased, providing an improved capability for measurement of ground feature radiance. D.H.

A86-21207#

MULTIDIMENSIONAL (SPECTRAL AND TEXTURAL) CLASSIFICATION METHOD AND SURFACE STATES MAPPING, APPROACH TO THE AGRICULTURAL ENVIRONMENT USING LANDSAT DATA IN NORTHERN AND NORTHEASTERN THAILAND

C. MONKOLSAWAT (Khon Kaen University, Thailand), M. BRUNEAU (CNRS, Centre d'Etudes de Geographie Tropicale, Talence, France), J. KILIAN (Groupement d'Etudes et de Recherches pour le Developpement de l'Agronomie Tropicale, Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres, Paris, France), P. H. RAKARIYATHAM (Chiang Mai University, Thailand), D. DUCROS-GAMBART (CNRS, Centre d'Etudes Spatiales des Rayonnements, Toulouse, France) et al. IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1309-1319. refs

Multispectral and textural supervised classifications of four Landsat CCTs have been used in two different agricultural areas of Thailand (mountains of the North, flat alluvial plain of the Mun river alternatively inundated and very dry) to produce surface states maps. Field observations, choice of the date, good quality of the data and of the visualization to allow an accurate location of the training fields are of paramount importance. The agricultural environments can be approached through agro-ecological landscape units that are associations of surface states delineated on the classified image. Crossing of classified images of different dates superimposed is a good method to study the evolution of the landscapes in its broad features. Author

A86-21214#

APPLICATION OF REMOTELY SENSED DIGITAL DATA AND A GEOGRAPHIC INFORMATION SYSTEM IN THE NATIONAL WILDLIFE REFUGE PLANNING PROCESS IN ALASKA

J. HENDERSON (U.S. Fish and Wildlife Service, Anchorage, AK) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1395-1403.

A86-21216#

INTEGRATION OF REMOTE SENSING DATA FOR MOORLAND MAPPING IN NORTHERN ENGLAND

R. E. WEAVER (Durham, University, England) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1417-1423.

A number of remote sensing data sets are examined to assess their potential for moorland mapping. Generally, the major communities are separable in Landsat data, a finer pixel size is needed to extract detail. The optimum position and number of spectral regions for fine scale mapping is specific to each vegetation type. Author

A86-21220#

THE USE OF REMOTE SENSING AND DETAILED PLANT USE INFORMATION FOR DEVELOPING A VEGETATION RESOURCE BASE MAP FOR USE IN INTEGRATED RESOURCE PLANNING IN WEST AFRICA

C. J. DORIGAN (Tibbets-Abbett-McCarthy-Stratton, New York) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1453-1462. refs

Landsat image interpretation is being used as an important means of land resources interpretation in integrated resource inventories covering extensive areas in West Africa. A significant amount of detailed plant use information exists for these regions being surveyed that has not yet been incorporated into the inventory maps and reports. Fish and Wildlife Habitat Suitability Index development procedures provide a model for integrating vegetation use information into these existing and future remote sensing/resource inventory data bases. Author

A86-21222#

DEER CENSUS USING A MULTISPECTRAL LINEAR ARRAY INSTRUMENT

C. L. WYATT, D. R. ANDERSON, R. HARSHBARGER (Utah State University of Agriculture and Applied Science, Logan), and M. M. TRIVEDI (Louisiana State University, Baton Rouge) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1475-1488. refs

An eight-year program has achieved success in detecting mule deer (Odocoileus hemionus) with a ground-based sensor as a precursor to an airborne census tool, for game management, which is capable of eliminating false counts and which provides an estimate of deer population. The system uses three ratio classifiers (0.74, 0.78, 0.86 micrometer ratioed with 1.0 micrometer) and scene brightness in the 1.0 micrometer band. Total population is estimated from the three partial counts using the capture-recapture algorithm. D.H.

A86-21223#

COUNTING BIG GAME BY AERIAL THERMOGRAPHY IN THE ARC-EN-BARROIS FOREST

R. BURKHALTER (Laboratoire National d'Essais, Paris, France) and B. KIENTZ (Societe Francaise d'Etudes et de Recherches Economiques et Statistiques, Chambery, France) IN: International Symposium on Remote Senting of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1489-1495. Research supported by Ministere de l'Environnement, Federation Departementale des Chasseurs, Office National de la Chasse and Office National des Forets.

A counting operation of big game by aerial thermography was done between February 14th and 19th, 1983 on 28,000 hectares, in the Arc-en-Barrois forest of Eastern France. A sosie analogic scanner operating between 10 and 12 microns was used for this study. The flight line was maintained through the use of a radar location system. The animals were inventoried by visual interpretation of 70 mm film data. 613 roebucks, 428 wild boar and 881 stags were counted. These results compared favorably with those obtained through traditional means of counting. Aerial thermography appears today as an operational tool for counting big game in deciduous forests in relatively flat areas. Author

A86-21229#

CROP IDENTIFICATION AND AREA ESTIMATION - AN APPROACH TO EVALUATE ARGENTINE MAIN CROP AREAS USING LANDSAT DATA

F. V. REDONDO, C. LAC PRUGENT, C. GARGANTINI, and M. ANTES (Comision Nacional de Investigaciones Espaciales, Centro de Sensores Remotos, Buenos Aires, Argentina) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1541-1549. refs

A combined use of ground and Landsat data is proposed in order to be able to estimate crop hectareage(wheat) in large areas using the satellite as a qualified enumerator. The method, based on a random sampling design on a stratified frame, defines a set of samples for which ground(n) and Landsat data is gathered and where the remaining samples segments are surveyed through satellite data(n'). The n set of data is used to estimate the accuracy of crop identification and to develop the regression estimates for the final estimation. The pilot experience here presented showed satisfactory results and a second phase of the study is being conducted. An optimum ratio n'/n will allow to get maximum efficiency/profit of the satellite aid system for crop estimation. Author

A86-21230#

THE VALUE OF DIRECT OBSERVATIONS OF CROP CANOPIES FOR INDICATING GROWING CONDITIONS AND YIELD

C. L. WIEGAND (USDA, Agricultural Research Service, Weslaco, TX) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1551-1560. refs

Agrometeorological crop growth/yield models are being developed that express the response of specific crops to their soil and aerial environments. Spectral observations that might serve either as (1) inputs or 'drivers' of such models, or (2) independent feedback to reset or overide the simulations are discussed and illustrated. Candidate spectral inputs include canopy temperature (in lieu of air temperature); vegetation indices as spectral surrogates of leaf area index and phytomass; seasonal vegetation index curves (spectral profiles) that contain information on growth rate, canopy senescence rate, and magnitude and duration of canopy greenness; and, light absorption estimates. The direct look at the canopies provided by sensors, e.g., those aboard the polar orbiting environmental satellites, Spot or Landsat-4 and -5, and expressed as vegetation indices are demonstrated to provide checks on canopy condition and yield. It is concluded that the vegetation indices capture information on canopy development and condition; respond to management and soil profile differences among fields that are not easily included in agrometeorological models; and, provide a means of quantifying canopy development in response to stresses. Thus there is merit in further developing spectral parameters for use in agrometeorological models. Author

A86-21231#

IDENTIFICATION AND MAPPING OF RICE PADDY IN SOUTHERN THAILAND USING SPACEBORNE IMAGING RADAR - PROBLEMS AND PROSPECTS

A. LIND (Vermont, University, Burlington) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1561-1569.

The use of L Band (23-cm) spaceborne radar data offers a potential solution to the problem of cloudiness in identifying and mapping rice lands in the wet, coastal lowlands of southern Thailand and on coastal barriers and alluvial plains. SIR-A radar imagery is investigated with a view toward identifying and mapping rice growing areas distributed among the coastal barrier and alluvial plain environments. The SIR-A imagery from orbit 30, obtained on November 13, 1981, was used for the investigation, and both visual and computer techniques were used, including enhancements by linear and Gaussian histogram stretching. Problems are noted along the coastal barrier where extremely high returns (from wet leaves of sugar palms bordering the paddies) mask the presence of flooded rice fields. D.H.

A86-21232#

SKYEYE - AN OPERATIONAL SYSTEM FOR CROP CONDITION MONITORING FROM LANDSAT IMAGES

M. KVARNSTROM, A. SODERMAN, and T. WESTIN (Satellite Image in Kiruna Corp., Kiruna, Sweden) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1571-1575.

Requirements are considered for an operational system that can assess crop conditions by using different combinations of sensors and image processing techniques. Such a system must be fast enough to give up-to-date information and it must cover large areas at a reasonable cost. Such a system has been developed and operational since 1983; called Skyeye, it covers Europe and the U.S.S.R. west of the Aral Sea. By using only Landsat data from bands 5 and 7, and degrading the ground resolution to 240 by 240 meters, it has been possible to use quick-look CCTs and thereby sharply lower the cost for data. The proximity of the Satellite Image Corporation to the Landsat receiving station at Esrange permits same-day analysis of the data and ensures timeliness for the users. D.H.

A86-21233#

EFFECTIVE INTEGRATION OF DATA SOURCES FOR OPTIMIZING RESOURCE INVENTORIES

N. E. G. ROLLER (Michigan, Environmental Research Institute, Ann Arbor) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1577-1603. refs

This paper describes methods for optimally integrating a variety of sources of resource description data into inventory procedures so that the resulting inventories are more accurate and useable by resource planners and managers. Several new sources of remote sensing data are described, and the considerations associated with selecting the proper combination of available data sources to meet the objectives of a resource inventory are discussed. Next, the issues involved in successfully integrating a combination of data sources into an optimal inventory procedure are described. The differences between map-based and statistically-based procedures are reviewed, and effective inventory procedures for both approaches are presented. Examples of properly integrated resource inventories are provided to illustrate the practical application of many of the methods described. Author

A86-21244#

CONTRIBUTION OF LANDSAT DATA TO MAPPING OF LAND RESOURCES IN ARID REGIONS - 'TATAHOUINE' AND 'ZARZIS' SHEETS OF 1/200,000 SOIL MAP OF TUNISIA

M. POUGET, B. LORTIC (Office de la Recherche Scientifique et Technique d'Outre Mer, Bureau de Teledetection, Bondy, France), A. SOUISSI (Direction des Sols, Tunis, Tunisia), R. ESCADAFAL (Mission ORSTOM, Gabes, Tunisia), and A. MTIMET (Direction des Sols, Gabes, Tunisia) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1717-1725. refs

In the area studied, spectral brightness (MSS Landsat 1-3) depends basically on the characters of the soil surfaces, particularly roughness (stoniness, crusting) and color, which is also closely connected with soil texture. Using an approach which closely combines field and laboratory work, a multispectral classification makes it possible to analyse the MSS data structure and to obtain a computerized map of soil surface conditions. Taking field observations into account, i.e., relationships between soils and soil surfaces, this document was interpreted for drawing up morphological map units. In the next step, several derived thematic maps can be obtained, for example: the land resources map (scale: 1/200,000). Author

A86-21247#

A PROCEDURE FOR THE EXTRACTION OF VEGETATION INFORMATION FROM NOAA AVHRR DATA

J. A. HOWARD, M. LORENZINI, and A. ZANDONELLA (UN, Food and Agriculture Organization, Rome, Italy) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1743-1750. refs

A procedure is presented for extracting from AVHRR data new features of interest for vegetation studies. Approach used consists in projecting AVHRR data, of selected channel pairs, in a standardized feature space and in selecing, in this space, the axes more representative of physical scene characteristics in relation to the position of centroids of the classes. Features extracted are related to vegetal greeness, soil conditions in terms of brightness and wetness and allotropic forms of water. Author

A86-21254#

EVALUATION AND USE OF SATELLITE PRODUCTS FOR AGRICULTURAL ASSESSMENTS

S. K. LEDUC (DOC; NOAA, National Environmental Satellite Data and Information Service, Columbia, MO) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1815-1820. refs

Satellite derived products are being evaluated and used to provide input to the agricultural assessment process in the U.S. and for other regions around the world. Vegetative growth and development are dependent on solar radiation. Solar radiation on the ground is estimated from the Geostationary Operational Environmental Satellite (GOES) data for the Western Hemisphere. These data were statistically compared to ground measurements of insolation. A vegetation index derived from the NOAA-7 polar orbiting satellite has been evaluated for assessment of vegetative conditions around the world. To help establish the deterministic component in the time series of the vegetation index, weighted averages based on land use have been developed. D.H.

A86-21255#

A CONTINUING DEVELOPMENT OF AN APPLICATION FOR LANDSAT DATA 1983 DCLC WINTER WHEAT ACREAGE ESTIMATES FOR FOUR STATES

P. W. COOK, G. MAY, and R. A. KESTLE (USDA, Washington, DC) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1821-1833. refs

A86-21258#

MAPPING AND EVALUATION OF ABOVE-GROUND PHYTOMASS - APPLICATION TO PERMANENT PASTURES

C. M. GIRARD (Paris-Girgnon, Institut National Agronomique, Thiverval-Grignon, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1855-1861.

The author gives the results of an experiment combining IRC aerial photographs, in the field observations and measurements, SPOT simulation data, and Landsat data. It shows that mapping and evaluation of permanent pastures and their instantaneous above-ground phytomass is possible. Author

A86-21259#

FOREST DAMAGE ASSESSMENT VIA ADVANCED IMAGE PROCESSING TECHNIQUES BASED ON TM-COMPATIBLE AIRBORNE SCANNER DATA

H. KAUFMANN, J. HENKEL, R. HAYDN, and B. KOCH (Muenchen, Universitaet, Munich, West Germany) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1863-1871. refs

A means of inventorying and monitoring damage to forests by disease, using a Bendix M-squared-S scanner, is described. Advanced image processing techniques are used to enhance the subtle differences between spruce trees damaged to different degrees, independently from such parameters as underlying vegetation, deciduous trees, shadows, etc., to improve the objectivity and accuracy of data evaluation and interpretation. D.H.

A86-21270#

TM VS. MSS IN OPERATIONAL PEATLAND INVENTORY

S. PALA (Ministry of Natural Resources, Ontario Centre for Remote Sensing, Toronto, Canada) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1961-1972.

A86-21271#

ANALYSIS OF MSS LANDSAT DATA FOR SMALL-SCALE SOIL SURVEYS IN THE HUMID TROPICS - TWO CASE STUDIES: KANDY AREA IN SRI LANKA AND CHANTABURI AREA IN SOUTHEAST THAILAND

L. A. VAN SLEEN (International Institute for Aerospace Survey and Earth Sciences, Enschede, Netherlands) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1973-1982. refs

Multispectral scanner Landsat data for small-scale soil surveys were analyzed using visual image interpretation (including fieldwork and limited aerial photo interpretation) and a number of digital image processing techniques. In the humid tropics, image interpretability of more pronounced relief, covered by evergreen vegetation, was found to depend above all on favorable solar azimuth. Flatter (often cultivated) landforms were best displayed by using a combination of wet and dry season images. Interpretability of structurally controlled relief forms could be somewhat improved by means of directional filtering techniques. D.H.

A86-21273#

REMOTE SENSING AND CROP PRODUCTION FORECASTING IN ITALY RESULTS AND FUTURE PROGRAMS

P. C. DE ANGELIS (Ministero dell' Agricoltura delle Foreste, Ufficio Centrale di Ecologia Agraria, Rome, Italy) and S. GIZZI (Consorzio ITA, Rome, Italy) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1993-2000.

A86-22564

TRANSFORMATION ERROR CORRELATIONS IN COMPUTER-AIDED FOREST MAPPING ON THE BASIS OF SPACE IMAGERY [SOOTNOSHENIIA DLIA OSHIBOK TRANSFORMIROVANIIA PRI AVTOMATIZIROVANNOM KARTOGRAFIROVANII LESOV PO KOSMICHESKIM SNIMKAM]

E. D. BODANSKII, D. A. STAROSTENKO, and R. I. ELMAN (Vsesoiuznoe Aerofotolesoustroitel'noe Ob'edinenie Lesproekt, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Sept.-Oct. 1985, p. 99-105. In Russian. refs

A86-22647

LARGE-SCALE SAMPLING PHOTOGRAPHY FOR FOREST HABITAT-TYPE IDENTIFICATION

W. BEFORT (New Hampshire, University, Durham) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, Jan. 1986, p. 101-108. refs

To learn whether or not forest sites could be classified as to ecological habitat type by use of large-scale aerial sampling photography, 156 stands in northern Idaho and eastern Washington were photographed at scales around 1:1000. A type-identification key was assembled, and five interpreters were asked to assign habitat type labels to 111 stereophoto sample strips representing 16 field-identified habitat types. A success rate of approximately 75 percent was achieved. Extreme misclassifications were rare, and interpretations were highly correlated with the positions of the types along a bioclimatic gradient. Author

A86-22837

PRELIMINARY EVALUATION OF SIMULATED SPOT DATA ACQUIRED 6 JULY, 1983, MORTON COUNTY, NORTH DAKOTA

E. S. MERRITT (Earth Satellite Corp., Chevy Chase, MD) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 109-114.

Preliminary analysis of simulated SPOT satellite data taken over Morton County, North Dakota on July 6, 1983 indicates significant potential for use in assessments of global agricultural conditions. The spectral and spatial resolution of the simulated data permits the preparation of analyses of agricultural conditions, crop type, etc. at a level heretofore not possible with Landsat MSS. Separation of small grains into spring wheat, barley and oats appears to be quite feasible. Water status can be easily assessed using small farm ponds less than 50 metres in size. Drainage condition in individual small fields is readily done. Future study needs to be directed to the application of the 'real' SPOT data in an effective global system. Author

A86-22838

DISCRIMINATION OF ORCHARD AND TRUCK CROPS NEAR OXNARD, CALIFORNIA USING SPOT SIMULATOR DATA

C. T. SAILER, L. J. MANN, J. E. ESTES, D. ECKHARDT, and S. GOETZ (California, University, Santa Barbara) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 115-121.

SPOT simulator data was used to evaluate the potential applicability of SPOT satellite data in the identification of cover types in agricultural lands. Procedures employed in this evaluation involved both manual and computer-assisted techniques. Computer-assisted techniques included both supervised and unsupervised procedures. Data were acquired for the Oxnard and Camarillo quadrangles Ventura County, California on June 23, 1983. The site selected for study was an area that is intensely farmed, with field sizes ranging from 1 to 74 acres, and has a highly variable planting/harvesting schedule with no existing crop calendar. This is primarily due to the climate which allows a year-round growing/planting season and to this area's rich, deep soils. Results indicate that the improved spatial resolution of this data permits a high level of mapping accuracy for manual and supervised classification procedures for a level of classification based on the Anderson et al. classification scheme. However, the temporal resolution of this sensor (26 day repeat cycle), even with increased frequency employing off-nadir viewing, is very much a research question and could be a major deterrent to the potential of SPOT data for operational use in agriculture. Author

A86-22839

AN ASSESSMENT OF SPOT SIMULATOR DATA FOR RANGELAND RESOURCE MAPPING

J. A. MASLANIK, R. A. MCKINLEY (Technicolor Government Services, Inc., Denver, CO), and W. J. BONNER, JR. (U.S. Bureau of Land Management, Denver, CO) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 122-129. refs

This paper presents initial results of research Bureau of Land Management investigators have conducted to date with the simulated SPOT 20m digital data. These studies have been conducted using data collected over an area (simulation Site 32) in Northwestern Arizona. Studies included assessment of the spatial and spectral characteristics of the data, as well as comparisons with Landsat Multispectral Scanner imagery. Results indicate that the high spatial resolution of the simulated SPOT data provides significant improvements over previous range vegetation classifications developed using Landsat MSS data. In addition, the data generate more visually pleasing and interpretable results due to the characteristics of smaller pixels. Author

A86-22847

WILDLIFE HABITAT MAPPING IN LAC QUI PARLE, MINNESOTA

C. J. MERRY (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, NH), G. GREEN, R. DEVENDORF (U.S. Army, Corps of Engineers, St. Paul, MN), and S. ANDERSON (Minnesota Land Management Information Center, St. Paul) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 205-208. Army-sponsored research.

SPOT High Resolution Visible (HRV) simulated data were obtained over Lac qui Parle, Minnesota, to determine their usefulness for mapping wildlife habitat categories associated with the U.S. Army Corps of Engineers projects. Ground truth data were available from photointerpreted wildlife habitat unit maps and the agricultural crop inventory prepared for the summer of 1983. A geometric correction could not be applied to the data set, so only the spectral reflectance quality of the data was assessed. The sample size of 512 X 512 pixels was selected for the analyses. An unsupervised classification land cover map was generated with the Earth Resources Laboratory Application Software package. The classification was successful in discriminating wheat and alfalfa, and other uniformly-colored areas, but pasture and corn could not be separated. Also, no success in separation of grasslands and legumes was achieved. THe results indicate that the 20-m HRV data can be used to photointerpret wildlife habitat using the false color image, but a digital classification cannot be performed. To obtain a habitat map using the HRV data would require a multitemporal analysis. Author

A86-22853

THE INTERPRETATION OF FOREST RESOURCES IN CALIFORNIA ON SIMULATED SPOT IMAGERY

S. D. DEGLORIA (California, University, Berkeley) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 267-274. Research supported by the University of California. refs

Simulated SPOT data were acquired over a western mixed conifer forest site in the northern Sierra Nevada of California for assessing the utility of these data for forest and soil inventory and forest land management plan development. Data collected coincident with the SPOT data acquisition included ground and low altitude aerial photography of selected sites. A subset of 1982 vegetation-soil characterization ground plots located within the SPOT data set were also used in the analysis. Snow cover at the time of data acquisition precluded analysis of the data in the true fir timber sites above 2000 m elevation. Analysis of the 'P' site data using the combined 1:24,000 scale false color composite of 10 m panchromatic and 20 m multispectral data indicate that the

SPOT data will allow: (1) the discrimination of forest stands of differing stand densities and size classes; (2) the plotting and navigating of primary, secondary, and tertiary road networks required for field survey and timber harvesting; (3) the discrimination of contrasting soil associations based on geologic, geomorphic, pedologic, and vegetative indicators interpreted on the image products; and (4) the delineation of land units comprising sites most suitable for reforestation practices. Author

A86-23206*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

EARLY WARNING AND CROP CONDITION ASSESSMENT RESEARCH

G. O. BOATWRIGHT and V. S. WHITEHEAD (NASA, Johnson Space Center; USDA, Agricultural Research Service, Houston, TX) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Jan. 1986, p. 54-64. refs

The Early Warning Crop Condition Assessment Project of AgRISTARS was a multiagency and multidisciplinary effort. Its mission and objectives were centered around development and testing of remote-sensing techniques that enhance operational methodologies for global crop-condition assessments. The project developed crop stress indicators models that provide data filter and alert capabilities for monitoring global agricultural conditions. The project developed a technique for using NOAA-n satellite advanced very-high-resolution radiometer (AVHRR) data for operational crop-condition assessments. This technology was transferred to the Foreign Agricultural Service of the USDA. The project developed a U.S. Great Plains data base that contains various meteorological parameters and vegetative index numbers (VIN) derived from AVHRR satellite data. It developed cloud screening techniques and scan angle correction models for AVHRR data. It also developed technology for using remotely acquired thermal data for crop water stress indicator modeling. The project provided basic technology including spectral characteristics of soils, water, stressed and nonstressed crop and range vegetation, solar zenith angle, and atmospheric and canopy structure effects. Author

A86-23207* Minnesota Univ., St. Paul.

FIELD SPECTROSCOPY OF AGRICULTURAL CROPS

M. E. BAUER (Minnesota, University, St. Paul), C. S. T. DAUGHTRY, L. L. BIEHL (Purdue University, West Lafayette, IN), E. T. KANEMASU (Kansas State University of Agriculture and Applied Science, Manhattan), and F. G. HALL (NASA, Goddard Space Flight Center, Greenbelt, MD) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Jan. 1986, p. 65-75. refs

The development of the full potential of multispectral data acquired from satellites, requires quantitative knowledge, and physical models of the spectral properties of specific earth surface features. Knowledge of the relationships between spectral-radiometric characteristics and important biophysical parameters of agricultural crops and soils can best be obtained by carefully controlled studies of fields or plots. It is important to select plots where data describing the agronomic-biophysical properties of the crop canopies and soil background are attainable, taking into account also the feasibility of frequent timely calibrated spectral measurements. The term 'field spectroscopy' is employed for this research. The present paper is concerned with field research which was sponsored by NASA as part of the AgRISTARS Supporting Research Project. Attention is given to field research objectives, field research instrumentation, measurement procedures, spectral-temporal profile modeling, and the effects of cultural and environmental factors on crop reflectance. G.R.

A86-23212* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

VEGETATION ASSESSMENT USING A COMBINATION OF VISIBLE, NEAR-IR, AND THERMAL-IR AVHRR DATA

V. S. WHITEHEAD (NASA, Johnson Space Center, Houston, TX), W. R. JOHNSON, and J. A. BOATRIGHT (Lockheed Engineering and Management Services Co., Inc., Houston, TX) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Jan. 1986, p. 107-112. refs

Twelve-hour temperature difference (thermal inertia) maps generated by rectifying and registering ascending (day) passes and descending (night) passes of the NOAA-7 Advanced Very High Resolution Radiometer (AVHRR) are compared to vegetation index maps generated from the visible and near IR data from the day pass of that satellite. There appears to be significant and unique information concerning surface characteristics in the temperature difference data on the 1-km scale of the AVHRR. A scatter diagram is provided which shows the pattern of day-night temperature difference compared to vegetation index for irrigated agriculture, dry rangeland, lakes, wet areas and burned rangeland. A detailed description of the techniques employed to provide the day-night temperature maps is provided. Author

A86-23213*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ANALYSIS OF FOREST STRUCTURE USING THEMATIC MAPPER SIMULATOR DATA

D. L. PETERSON, W. E. WESTMAN, J. A. BRASS (NASA, Ames Research Center, Moffett Field, CA), N. J. STEPHENSON (Cornell University, Ithaca, NY), V. G. AMBROSIA, M. A. SPANNER (NASA, Ames Research Center; Technicolor Government Services, Inc., Moffett Field, CA) et al. IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Jan. 1986, p. 113-121. refs

The potential of Thematic Mapper Simulator (TMS) data for sensing forest structure information has been explored by principal components and feature selection techniques. In a survey of forest structural properties conducted for 123 field sites of the Sequoia National Park, the canopy closure could be well estimated (r = 0.62 to 0.69) by a variety of channel bands and band ratios, without reference to the forest type. Estimation of the basal area was less successful (r = 0.51 or less) on the average, but could be improved for certain forest types when data were stratified by floristic composition. To achieve such a stratification, individual sites were ordinated by a detrended correspondence analysis based on the canopy of dominant species. The analysis of forest structure in the Sequoia data suggests that total basal area can be best predicted in stands of lower density, and in younger even-aged managed stands. I.S.

A86-23214#

A CORRELATION AND REGRESSION ANALYSIS OF PERCENT CANOPY CLOSURE VERSUS TMS SPECTRAL RESPONSE FOR SELECTED FOREST SITES IN THE SAN JUAN NATIONAL FOREST, COLORADO

M. K. BUTERA (Science Applications International Corp., Washington, DC) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Jan. 1986, p. 122-129. refs

This investigation tested the correlation of canopy closure with the signal response of individual Thematic Mapper Simulator (TMS) bands for selected forest sites in the San Juan National Forest, Colorado. Ground truth consisted of a photointerpreted determination of percent canopy closure of 0-100 percent for 32 sites. The sites selected were situated on plateaus at an elevation of approximately 3 km with slope less than or equal to 10 percent. The predominant tree species were ponderosa pine and aspen. The mean TMS response per band per site was calculated from data acquired by aircraft during mid-September, 1981. A correlation analysis of TMS response versus canopy closure resulted in the following correlation coefficients for bands 1-7, respectively:-0.757, -0.663, -0.666, -0.088, -0.797, -0.597, -0.763. Two model regressions were applied to the TMS data set to create a map of

predicted percent forest canopy closure for the study area. Results indicated percent predictive accuracies of 71, 74, and 57 for percent canopy closure classes of 0-25, 25-75, and 75-100, respectively.
Author

A86-23215*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

USE OF REMOTELY SENSED DATA FOR ASSESSING FOREST STAND CONDITIONS IN THE EASTERN UNITED STATES

D. L. WILLIAMS and R. F. NELSON (NASA, Goddard Space Flight Center, Greenbelt, MD) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Jan. 1986, p. 130-138. refs

Techniques for the detection, classification, and measurement of forest disturbances, using digital Landsat data for three study areas (Pennsylvania, North Carolina, and Maine) are reported. Results with respect to (1) the delineation and assessment of forest damage due to the use of two forest insect defoliators, and (2) qualitative assessment of the Multispectral Scanner (MSS) and the Thematic Mapper data for delineating forest stand characteristics are presented. Key results include a development of a statewide MSS digital data base and associated image-processing techniques for accurately delineating insect-damaged and healthy forest areas. For classification of broad land-cover classes which are spectrally homogeneous, the accuracy yielded by the use of either MSS data or TM Simulator data is similar. However, the TMS data provided 20 percent accuracy improvement over the MSS results when detailed (Level III) forest classes were mapped.
I.S.

A86-24310

MEASUREMENT OF ECOLOGICAL DESERTIFICATION TRENDS ON SEQUENTIAL REMOTE-SENSING PHOTOGRAPHS [IZMERENIE EKOLOGICHESKOI TENDENTSII OPUSTYNIVANIIA PO POVTORNYM AEROKOSMICHESKIM SNIMKAM]

B. V. VINOGRADOV, V. V. LEBEDEV, K. N. KULIK, and A. N. KAPTSOV (AN SSSR, Institut Evoliutsionnoi Morfologii i Ekologii Zhivotnykh, Moscow, USSR; Tsentr Podgotovki Kosmonavtov, USSR; Vsesoiuznyi Nauchno-Issledovatel'skii Agrolesomeliorativnyi Institut, Volgograd, USSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 285, no. 5, 1985, p. 1269-1272. In Russian. refs

The possibility of using sequential remote-sensing photographs to study ecological desertification trends is demonstrated on a quantitative study of the dynamics of the desert-pasture ecosystem of the black lands of the Kalmytskaia ASSR, one of the largest examples of a desertification locus in the USSR. The method developed makes possible the mathematical expression of the desertification trend and the extrapolation of the trend over a period of 8-16 years.
B.J.

A86-25479

INTERPRETATION OF THE SOIL COVER OF NONCHERNOZEM AREAS ON DIFFERENT TYPES OF SPACE PHOTOGRAPHS IN CONNECTION WITH THE COMPILATION OF SMALL-SCALE SOIL MAPS [DESHIFRIROVANIE POCHVENNOGO POKROVA NECHERNOZEM'IA NA KOSMICHESKIKH FOTOSNIMKAKH RAZNYKH TIPOV PRI SOSTAVLENII MELKOMASSTABNYKH POCHVENNYKH KART]

M. S. SIMAKOVA (Pochvennyi Institut, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Nov.-Dec. 1985, p. 22-27. In Russian.

Space photographs of several scales and types (black and white composite, multispectral, and color band-selective) for nonchernozem areas are interpreted in terms of soil cover. A morphometric analysis of mesorelief forms, based on medium-scale topographic maps and aerial photographs, is used to select optimal scales and types of photographs for the compilation of small-scale soil maps.
B.J.

A86-25481

POSSIBILITY OF THE REMOTE LASER DETERMINATION OF THE CONDITION OF AGRICULTURAL CROPS ACCORDING TO THEIR LUMINESCENCE CHARACTERISTICS [O VOZMOZHNOSTI DISTANTSIONNOI LAZERNOI DIAGNOSTIKI SOSTOIANIIA SEL'SKOKHOZIAISTVENNYKH KUL'TUR PO IKH LIUMINESTSENTNYM KHARAKTERISTIKAM]

V. A. KANEVSKII, V. F. RIAZANTSEV, O. N. PEREKREST, V. P. ILIN, IA. I. MOVCHAN (AN USSR, Institut Botaniki, Kiev, Ukrainian SSR; AN MSSR, Tsentr Avtomatizatsii Nauchnykh Issledovanii i Metrologii, Kishinev, Moldavian SSR) et al. Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Nov.-Dec. 1985, p. 37-39. In Russian.

The luminescence intensities of crop fields have been remotely measured using a helicopter-borne laser. The data reveal the dependence of the ratio of luminescences measured at 685 and 735 nm on the fertilizer application rate, the amount of chlorophyll, and the dry biomass of the vegetation.
B.J.

A86-26225* Delaware Univ., Newark.

THE USE OF AIRBORNE IMAGING SPECTROMETER (AIS) DATA TO DIFFERENTIATE MARSH VEGETATION

M. F. GROSS and V. KLEMAS (Delaware, University, Newark) Remote Sensing of Environment (ISSN 0034-4257), vol. 19, Feb. 1986, p. 97-103. Research supported by the University of Delaware and NASA. refs

The Airborne Imaging Spectrometer (AIS) is a high spectral resolution (9.6-nm-wide bands between 0.9 and 2.4 microns) instrument. Analysis of AIS data revealed significant differences in characteristics of the spectral radiance curves of four types of wetland vegetation canopies (trees, broadleaf herbaceous, Spartina alterniflora, and S. patens/Distichlis spicata) in Delaware, enabling them to be distinguished. The single most useful spectral region was that between 1.40 and 1.90 microns. Differences in radiance values at various wavelengths between samples of the same vegetation type could potentially be used to estimate biomass. Thus, high spectral resolution spectrometry appears to have significant value for remote sensing studies of wetland vegetation.
Author

A86-26695

SEASONAL CONSISTENCY OF SALT-MARSH VEGETATION CLASSES CLASSIFIED FROM LARGE-SCALE COLOR INFRARED AERIAL PHOTOGRAPHS

P. E. R. DALE, K. HULSMAN, and A. L. CHANDICA (Griffith University, Nathan, Australia) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, Feb. 1986, p. 243-250. Research supported by Griffith University and Gold Coast City Council. refs

CIR aerial photographs taken over a south-east Queensland salt-marsh in autumn and spring were enlarged to a scale of 1:1100. Print reflectances at sample sites - calculated from measurements through the neutral, blue, green, and red filters of a densitometer - were used as attributes in a divisive clustering procedure. The classes generated were compared in terms of their site membership, discriminating attributes, and relationship with vegetation data from field sampling. Although reflectances varied seasonally, the classification results were similar for each season and the vegetation characteristics corresponded well to the classes generated. The greatest seasonal differences occurred in reflectance through the red and blue filters, representing the infrared and green spectral bands. The photographs taken in autumn, with high red reflectances, provided maximum discrimination between the classes.
Author

A86-29404

VIDEO DIGITIZATION OF AERIAL PHOTOGRAPHS FOR MEASUREMENT OF WIND EROSION DAMAGE ON CONVERTED RANGELAND

J. G. LYON, J. T. HEINEN (Ohio State University, Columbus), and J. F. MCCARTHY (Northern Arizona University, Flagstaff, AZ) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, March 1986, p. 373-377. refs

This project developed a practical approach for measuring the area of wind erosion damage on rangeland converted to farmland. The selected study area consisted of 7,150 ha that was rangeland before 1954. A video graphics microcomputer system enhanced and digitized aerial photographs to measure the area of wind erosion or blowouts and the proportion of cotton cover crop on the selected farms. The result was that 23 percent of the total study area showed signs of wind erosion damage. Author

A86-29405

ALPINE VEGETATION CLASSIFICATION USING HIGH RESOLUTION AERIAL IMAGERY AND TOPOCLIMATIC INDEX VALUES

T. D. FRANK and S. A. ISARD (Illinois, University, Urbana) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, March 1986, p. 381-388. refs

Topoclimatic index values, representing the primary direct determinants of vegetation distribution in the mid-latitude alpine tundra, are combined with film density data from a color infrared aerial photograph to numerically derive a vegetation map of the Saddle area on Niwot Ridge, Colorado. Firm density is used to distinguish between moist or wet vegetation that receives a continuous supply of meltwater and dry vegetation types that rely on precipitation water input. Topoclimatic index values represent (1) the effect of slope-aspect in relation to prevailing wind direction on snow accumulation and (2) the effect of isolation on evapotranspiration and, consequently, soil moisture status. The vegetation classification reveals that combining topoclimatic and film density data produces an alpine map of high categorical accuracy. Author

A86-29407

EVALUATION OF THE EFFECTS OF PHOTO MEASUREMENT ERRORS ON PREDICTIONS OF STAND VOLUME FROM AERIAL PHOTOGRAPHY

J. L. SMITH (Virginia Polytechnic Institute and State University, Blacksburg) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, March 1986, p. 401-410. refs

A simple and flexible technique was developed for assessing the impact of photo measurement errors on aerial-photo-based volume predictions. The method utilizes random numbers from distributions as substitutes for actual measurement errors, and thus is able to handle errors of many types and sizes without making restrictive assumptions. The procedure allows the user to examine the properties of the fitted models that are of interest. The proposed technique is demonstrated on Southern pine and Douglas-fir data sets. Author

N86-16688*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.

DEVELOPMENT OF COMPUTER SOFTWARE TO ANALYZE ENTIRE LANDSAT SCENES AND TO SUMMARIZE CLASSIFICATION RESULTS OF VARIABLE-SIZE POLYGONS Final Report

B. J. TURNER, Principal Investigator, G. M. BAUMER, W. L. MYERS, and S. G. SYKES May 1981 29 p refs Original contains imagery. Original photographs may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS5-26166)
(E86-10020; NASA-CR-177826; NAS 1.26:177826; PSU-IRLWR-RP-106/OR) Avail: NTIS HC A03/MF A01 CSCL 08B

The Forest Pest Management Division (FPMD) of the Pennsylvania Bureau of Forestry has the responsibility for conducting annual surveys of the State's forest lands to accurately detect, map, and appraise forest insect infestations. A standardized, timely, and cost-effective method of accurately surveying forests and their condition should enhance the probability of suppressing infestations. The repetitive and synoptic coverage provided by LANDSAT (formerly ERTS) makes such satellite-derived data potentially attractive as a survey medium for monitoring forest insect damage over large areas. Forest Pest Management Division personnel have expressed keen interest in LANDSAT data and have informally cooperated with NASA/Goddard Space Flight Center (GSFC) since 1976 in the development of techniques to facilitate their use. The results of this work indicate that it may be feasible to use LANDSAT digital data to conduct annual surveys of insect defoliation of hardwood forests. Author

N86-16694*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

COMPARISON OF THE INFORMATION CONTENTS OF LANDSAT TM AND MSS DATA

W. A. MALILA *In its* Study on Spectral/Radiometric Characteristics of the Thematic Mapper for Land Use Applications p 39-48 Sep. 1985 refs Repr. from Photogrammetric Engineering and Remote Sensing, v. 51, no. 9, Sep. 1985 p 1449-1457 Previously announced in IAA as A85-47822 ERTS
Avail: NTIS HC A04/MF A01 CSCL 08B

A communications-theory approach is taken to analyze the dispersion and concentration of signal values in various data spaces, irrespective of specific class membership. Entropy is used to quantify information, and mutual information is used to measure the information represented by subsets of spectral variables. Several different comparisons of information content are made. These include comparisons of system design capacities, of data volumes occupied by agricultural data in the spaces defined by original bands and by transformed spectral (Tasseled Cap) variables, of the information contents of original bands and Tasseled Cap variables, and of the information contents of TM and MSS for the given agricultural data sets. Also, the effects of sample size, scene content, and quantization level are examined. Author

N86-16700# South Carolina Univ., Columbia. Dept. of Geography.

REMOTE SENSING FOREST BIOMASS FOR LOBLOLLY PINE USING HIGH RESOLUTION AIRBORNE SENSOR DATA

J. R. JENSEN, M. E. HODGSON, and H. E. MACKEY, JR. 1985 30 p refs Presented at the Forest Land Applications Symposium, Seattle, Wash., 25 Jun. 1985 Prepared in cooperation with Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
(Contract DE-AC09-76SR-00001)
(DE85-017058; DP-MS-85-62; CONF-8506167-2) Avail: NTIS HC A03/MF A01

The amount and spatial distribution of vegetation are important parameters useful in agriculture, forestry, wetland, and hydrologic research. Such data may be collected in situ by harvesting a sample of the vegetation and determining the amount of biological matter. This approach provides single point estimates which are expensive to collect and difficult to extend through space in order to map the geographic distribution of biomass. It is, however, possible in certain instances to obtain acceptable estimates of biomass by analyzing remotely sensed data. This paper describes the analysis of very high resolution, remotely sensed data of loblolly pine (Pinus taeda) in a controlled experiment in South Carolina. Loblolly pine was examined because it represents over 70% of the commercial forest in the southeastern United States. Pine plots located on both sandy and clay soils were treated with sewage sludge to provide 0, 445, or 890 kg of nitrogen per hectare. Indices of biomass from remote sensing data were significantly correlated with in situ biomass measurements made in each plot. A ratio of infrared (0.9 to 1.1. micron m) and red (0.65 to 0.70 micron m) channels yielded the best correlation between the remote sensing data and the in situ biomass measurements. In addition, remote sensing provided a quantitative map of the spatial distribution of the biomass in the forest plots. The indices of biomass from the remote sensing data were not sensitive to differences in soil type (sandy or clay). DOE

N86-16701# South Carolina Univ., Columbia. Dept. of Geography.

REMOTE SENSING INLAND WETLANDS: A MULTISPECTRAL APPROACH

J. R. JENSEN, M. E. HODGSON, E. CHRISTENSEN, H. E. MACKEY, JR., L. R. TINNEY, and R. SHARITZ 1985 36 p refs Prepared in cooperation with Du Pont de Nemours (E.I.) and Co., Aiken, S.C. and Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.
(Contract DE-AC09-76SR-00001)
(DE85-017060; DP-MS-85-68) Avail: NTIS HC A03/MF A01

Airborne Multispectral Scanner (MSS) data, large-scale aerial photography, and LANDSAT MSS and Thematic Mapper (TM) data is used to map a variety of wetland conditions along the Savannah River watershed in South Carolina. Predawn thermal infrared MSS imagery is analyzed to map the spatial distribution and migration of thermal effluent entering a portion of the Savannah River floodplain and the Savannah River below Augusta, Georgia. Daytime airborne MSS data are used to classify specific wetland vegetation types and associate them with their apparent (remotely sensed) temperature. Large scale, multiple data aerial photography are ideally suited to follow the growth of vegetational changes associated with the thermal discharges into the floodplain. LANDSAT MSS imagery obtained in the spring is used effectively to map the entire Savannah River watershed. LANDSAT TM imagery obtained in the summer is of limited use in regional wetland mapping. DOE

N86-17609# Wageningen Agricultural Univ. (Netherlands). Soil Survey Inst.

THE 1984 L-BAND RADAR EXPERIMENT. PART 1: GROUND TRUTH FLEVO (NETHERLANDS) 1984 M.S. Thesis

L. STROOSNIJDER, J. STOLP, and G. G. LEMOINE 1984 86 p refs Original contains color illustrations
Avail: NTIS HC A05/MF A01

Ground truth of a polder area (7000 ha) was established for the SIR-B radar (which failed due to technical problems). A 10 km long light track of an airborne L-band scatterometer located diagonally over the test area is analyzed, resulting in soil moisture, surface roughness, and vegetation data. Data for 15 fields are determined as field averages of areas of 25 ha and may be considered representative for the 75 ha large fields. Analysis of the spatial dependency of soil moisture content, and the statistical accuracy of its determination, shows that 9 samples, distributed in a regular grid, produce a sufficiently accurate mean value over the 25 ha on each field. Author (ESA)

N86-17825# Hunting Geology and Geophysics Ltd., Boreham Wood (England).

STUDY OF A LAND USE OF SYNTHETIC APERTURE RADAR, EXECUTIVE SUMMARY

Paris ESA Sep. 1984 13 p 2 Vol.
(Contract ESTEC-5778/83/NL-MS)
(ESA-CR(P)-2067-VOL-1) Avail: NTIS HC A02/MF A01

Characteristics of a SAR satellite and data interpretation system for land-use monitoring in Europe were investigated. Empirical data and surface and volume scattering theories do not allow clear definition of satellite parameters, due to lack of comprehensive datasets. Human and computer analysis are compared. Computer implementation of surface scattering models and a volume scattering model is described, and results of parametric and time-development studies are presented. User-defined requirements for a land use SAR are described. Criteria for manual interpretation of images are defined. Machine measures of texture are applied to SAR 580 data. Results indicate that human and machine estimates of texture differ because of speckle and that for crops, texture measures provide no more information than the mean backscatter. Image comparisons based on color compositing of smoothed and unsmoothed images are described, and the effects of filters compared. The methods are applied to multifrequency and multitemporal data. Author (ESA)

N86-17826# Hunting Geology and Geophysics Ltd., Boreham Wood (England).

STUDY OF A LAND USE OF SYNTHETIC APERTURE RADAR. VOLUME 1: MAIN REPORT Final Report

Paris ESA Sep. 1984 196 p refs 2 Vol.
(Contract ESTEC-5778/83/NL-MS)
(ESA-CR(P)-2067-VOL-2) Avail: NTIS HC A09/MF A01

Characteristics of a SAR satellite and data interpretation system for land-use monitoring in Europe were investigated. Empirical data and surface and volume scattering theories do not allow clear definition of satellite parameters, due to lack of comprehensive datasets. Human and computer analysis are compared. Computer implementation of surface scattering models and a volume scattering model is described, and results of parametric and time-development studies are presented. User-defined requirements for a land use SAR are described. Criteria for manual interpretation of images are defined. Machine measures of texture are applied to SAR 580 data. Results indicate that human and machine estimates of texture differ because of speckle and that for crops, texture measures provide no more information than the mean backscatter. Image comparisons based on color compositing of smoothed and unsmoothed images are described, and the effects of filters compared. The methods are applied to multifrequency and multitemporal data. Author (ESA)

N86-18354# Marconi Co. Ltd., Chelmsford (England).

THE DEVELOPMENT OF AUTOMATIC METHODS FOR HANDLING SAR IMAGES OVER LAND

S. QUEGAN, N. J. VECK, A. WRIGHT, D. CRUSE, and J. SKINGLEY *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 23-29 Jun. 1985 refs Sponsored by ESA
Avail: NTIS HC A12/MF A01

Aspects of image handling relevant to a SAR producing images over land, particularly for monitoring agriculture and forestry, are discussed. Identification of ground cover type (classification); change detection; and change interpretation are considered. Segment-growing methods, algorithm performance, and thin line detection as part of the segmentation process are treated. After segmentation, shape and texture of segments can be measured. Work on the former and a comparison of man and machine perceptions of texture are described. Registration requires feature extraction, and results indicate that automatic correlation methods appear viable for speckled images. Calibration, classification, and interpretation of change require more experimental data, and merging of data from sources apart from the SAR. Author (ESA)

N86-18766*# Purdue Univ., West Lafayette, Ind. Lab. for Applications of Remote Sensing.

CHARACTERIZATION OF VEGETATION BY MICROWAVE AND OPTICAL REMOTE SENSING Semiannual Status Report, Aug. 1985 - Jan. 1986

C. S. T. DAUGHTRY, Principal Investigator, K. J. RANSON, and L. L. BIEHL Jan. 1986 15 p refs ERTS
(Contract NAGW-799)
(E86-10012; NASA-CR-176405; NAS 1.26:176405) Avail: NTIS HC A02/MF A01 CSCL 02C

Two series of carefully controlled experiments were conducted. First, plots of important crops (corn, soybeans, and sorghum), prairie grasses (big bluestem, switchgrass, tal fescue, orchardgrass, bromegrass), and forage legumes (alfalfa, red clover, and crown vetch) were manipulated to produce wide ranges of phytomass, leaf area index, and canopy architecture. Second, coniferous forest canopies were simulated using small balsam fir trees grown in large pots of soil and arranged systematically on a large (5 m) platform. Rotating the platform produced many new canopies for frequency and spatial averaging of the backscatter signal. In both series of experiments, backscatter of 5.0 GHz (C-Band) was measured as a function of view angle and polarization. Biophysical measurements included leaf area index, fresh and dry phytomass, water content of canopy elements, canopy height, and soil roughness and moisture content. For a subset of the above plots, additional measurements were acquired to exercise microwave backscatter models. These measurements included size and shape of leaves, stems, and fruit and the probability density function of leaf and stem angles. The relationships of the backscattering coefficients and the biophysical properties of the canopies were evaluated using statistical correlations, analysis of variance, and regression analysis. Results from the corn density and balsam fir experiments are discussed and analyses of data from the other experiments are summarized. M.G.

N86-19755# National Aeronautical Establishment, Ottawa (Ontario).

A FIELD STUDY OF GROUND DEPOSITION, WIND DRIFT AND BYSTANDER EXPOSURE FROM AGRICULTURAL AIRCRAFT SPRAY EMISSIONS

R. S. CRABBE and M. MCCOOEYE Jul. 1985 42 p (AD-A160891; NAE-AN-30; NRC-24745) Avail: NTIS HC A03/MF A01 CSCL 02A

Wind drift, deposition and bystander exposure measurements from agricultural aircraft and ground-rig spray emissions over rural terrain using conventional spray booms and atomizers are presented. A single line was treated. The formulations were aqueous oil emulsions to simulate herbicide applications and aqueous wettable powder emulsions to represent fungicide sprays. Meteorological conditions varied from calm thermally unstable to near-neutral moderately windy (4.9 ms -1 at 4 m above ground). Time-integrated atmospheric droplet concentrations (dosage) were measured at breathing height to 500 m downwind and vertically to drift cloud top at 200 and 500 m downwind. Analysis of field data disclosed initial ground deposit accounting for nearly 100% of the nonvolatiles in the ground-rig emission, but only from 60 to 80% of the aircraft emission depending upon wind speed, in agreement with published data. When transformed into the equivalent operational multi-swath crosswind incremental spray scenario, the data indicated bystander dermal exposures to nonvolatiles at 75 m downwind increasing from 150 microgram for the first swath to 600 microgram after 10 swaths in light winds (2.8 ms -1 at 4 m agl). At 200 m the measured drift cloud mass from the aircraft sprays varied from 1 to 2% of the emission in light winds. In this connection, 90 deg nozzle orientation on the aircraft resulted in greater wind drift than trailing orientation. The wettable-powder drift data revealed that at and beyond 75 m where spray evaporation was essentially complete, the dermal exposure could be less than from herbicide sprays due to the possibility of particle rebound from collecting surfaces. GRA

N86-20239# Joint Publications Research Service, Arlington, Va.

VARIABILITY OF COLOR COORDINATES OF SOME SOILS ACCORDING TO AIRCRAFT MEASUREMENT DATA Abstract Only

K. Y. KONDRATYEV, V. V. KOZODEROV, P. P. FEDCHENKO, S. M. SOMOVA, and L. B. KARVOVSKAYA *In its* USSR Report: Space (JPRS-USP-86-001) p 137-138 13 Jan. 1986 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1985 p 29-40

Avail: NTIS HC A03

A method for measuring the humus content in agricultural soils is described. In this method an aircraft carries a spectrometer used in measuring the spectral brightness coefficients (SBC) in the visible wavelength region which are then used in computing color coordinates quantitatively characterizing the humus content. Then the quantity of humus in soils is computed using a preconstructed calibration curve. Three types of soils were involved in this study: soddy-podzolic, gray forest and chernozem, located in a number of oblasts. Observations were made along measurement lines situated approximately 50 km apart for which SBC measurements were made. The spectral reflection curves were used in computing the color coordinates and determining the humus content at the measurement points. Observations were made from an AN-2 aircraft from a mean altitude of 100 m; measurements were made at a solar altitude greater than 40 deg. Photometric measurements of all the investigatated soils were made twice (1973 and 1981). The analyzed data revealed that aircraft spectrophotometric measurements can be used successfully in studying the dynamics of soil humus content. However, the method is suitable only for chernozems and possibly gray forest soils. Author

N86-20240# Joint Publications Research Service, Arlington, Va.

EXPERIENCE IN MAPPING EARTH ON BASIS OF SPACE PHOTOINFORMATION Abstract Only

L. N. KULESHOV *In its* USSR Report: Space (JPRS-USP-86-001) p 138 13 Jan. 1986 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1985 p 41-44 Original language document was announced in IAA as A85-37117

Avail: NTIS HC A03

The use of photographic images obtained in space to compile large scale (1:500,000) thematic maps of agricultural land in the Kalmyk territory of the USSR is evaluated. It is shown that the information content of space images may vary according to the type of map being compiled: for maps of the topographical features and uses of agricultural land, 70 percent of the data extracted from space images was useful; for maps of soil types, only 40 percent of the photographic information data was useful. I.H. (IAA)

N86-20245# Joint Publications Research Service, Arlington, Va.

AUTOMATED SPECTRAL ANALYSIS OF DIMENSIONS AND DIRECTIONS OF STRUCTURAL ELEMENTS ON EARTH'S SURFACE Abstract Only

D. K. TKHABISIMOV, D. A. UISKOV, and M. I. KOLSENIK *In its* USSR Report: Space (JPRS-USP-86-001) p 143 13 Jan. 1986 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1985 p 3-80

Avail: NTIS HC A03

A method for a structural-zonal survey of the Earth's surface from space is proposed. In this method the surface is viewed through a moving window containing N X N resolution elements, which is called an operational unit. Some functionals, such as a matrix of integral relative energies in several zones of a Wiener spectrum (in a polar coordinate system), are computed for each operational unit. The Ziman method is used in determining the sizes of tree crowns and discriminating the predominant directions of lineaments on photographs of the Earth's surface. For each photograph fragment it is necessary to compute the functions C(m) and L(n) whose values correspond to the part of Wiener spectrum energy falling within annular and slit filters respectively. The analysis was made for models of a forest and lineament structures with a uniform distribution (with respect to positions and sizes), and also for real photographs. Maps of crown size were constructed by correlation analysis of Wiener spectra. The discriminated directions are determined by the local maxima of the L(n) function. A full algorithm is given for automated fragment-by-fragment spectral analysis of images. An analysis of models of images of structural elements is used in developing a method for retrieving the probability distribution function for tree crown sizes from the Fourier spectrum. Author

N86-20246# Joint Publications Research Service, Arlington, Va.

USE OF MATERIALS FROM LARGE-SCALE AERIAL PHOTOSURVEY OF FOREST IN AUTOMATED INTERPRETATION OF SPACE PHOTOGRAPHS Abstract Only

L. A. KUZENKOV, N. A. APARINOVA, and A. V. STARCHENKO *In its* USSR Report: Space (JPRS-USP-86-001) p 143-144 13 Jan. 1986 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa(Moscow, USSR), no. 2, Mar. - Apr. 1985 p 90-96 Original language document was announced in IAA as A85-37119

Avail: NTIS HC A03

A step-wise numerical technique to process large scale aerial survey data for forestry applications is described. The method is based on the SNIMOK-DANNYE computer system for processing photographic data obtained by satellite. A block diagram illustrating the step-wise processing procedure is given and the statistical correlation used to match forest features with suitable deciphering indicators is described. The technique has been used to process photographic data from 30 different aerial surveys of forest land in Iakutsk, USSR, and was found to be practical for widespread use. I.H. (IAA)

N86-20254# Joint Publications Research Service, Arlington, Va.
COMPREHENSIVE DESERTIFICATION MAPS AND METHODOLOGY FOR THEIR COMPILATION USING SPACE PHOTOGRAPHS Abstract Only
N. G. KHARIN *In its* USSR Report: Space (JPRS-USP-86-001) p 150 13 Jan. 1986 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 1, Jan. - Feb. 1985 p 52-59 Original language document was announced in IAA as A85-29907
Avail: NTIS HC A03

Quantitative criteria of desertification are proposed, and a method for the compilation of desertification maps on the basis of space remote sensing data is developed. The desertification aspects include the current status, the rate and inherent risk of desertification, and the effect of animals and humans on the environment. LANDSAT and Soyuz-22 data on southeast Turmenistan considered. B.J.(IAA)

N86-20255# Joint Publications Research Service, Arlington, Va.
USE OF SPACE METHODS FOR STUDYING SALINE SOILS AND SOLONCHAKS Abstract Only
E. A. MAMEDOV *In its* USSR Report: Space (JPRS-USP-86-001) p 151 13 Jan. 1986 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 1, Jan. - Feb. 1985 p 60-65 Original language document was announced in IAA as A85-29908
Avail: NTIS HC A03

There is a spatial-temporal variability of saline lands which requires a constant inventory of their area and state and a systematic revision and correction of soil maps. A high percentage of the lands in the Azerbaijan SSR falls in this category. Work in the Adzhinourskaya steppe is described. Key sectors have been covered by detailed geobotanical surveys on the ground, taking into account the seasonal variability of the vegetation cover. After preparation of a detailed map of the key area on the basis of aerial photographs and ground field work, it was possible to proceed to interpretation and mapping on the basis of space photographs. The 1972 space photographs used were from the LANDSAT satellite in four spectral zones. It was found that the most effective spectral zones for the mapping of saline soils are 0.6 to 0.7 and 0.8 to 1.1 micrometers. The use of maps prepared from space photographs greatly increased the detail of the maps in comparison with those prepared by traditional methods, clearly revealing the natural pattern of soil and vegetation groupings, increasing the number of varieties of saline and swampy soils and solonchaks by a factor 2 to 3. The outlines of individual soil areas discriminated on the basis of phototone and color fully corresponded to the results of field mapping and data from physiochemical analysis. It was concluded that in Azerbaijan such work is best accomplished using multizonal photographs taken in July-August at wavelengths 0.5 to 0.6 and 0.6 to 0.7 micrometers. R.J.F.

N86-20257# Joint Publications Research Service, Arlington, Va.
RADAR MAPPING OF MOISTURE CONTENT OF OPEN SOILS Abstract Only
N. N. KRUPENIO *In its* USSR Report: Space (JPRS-USP-86-001) p 152-153 13 Jan. 1986 Transl. into ENGLISH from Issledovaniya Zemli iz Kosmosa (Moscow, USSR), no. 1, Jan. - Feb. 1985 p 88-93 Original language document was announced in IAA as A85-29911
Avail: NTIS HC A03

Airborne sidelooking radar with a 60-100 m resolution was used for the moisture mapping of open soils (i.e., without vegetation cover) in the 0-10 cm layer in the Stavropol'sk region of the USSR. The difference between the moisture value obtained by the remote radar measurements and that obtained by direct thermoweight measurements did not exceed 2 wt percent in the 9-30 percent moisture variation range. B.J. (IAA)

N86-20270# Joint Publications Research Service, Arlington, Va.
MAPPING OF VEGETATION RESOURCES OF ARID ZONES USING SPACE PHOTOINFORMATION Abstract Only
V. S. KHRUTSKIY *In its* USSR Report: Space (JPRS-USP-86-001) p 163 13 Jan. 1986 Transl. into ENGLISH from Geodeziya i Kartografiya (Moscow, USSR), no. 9, Sep. 1984 p 51-56 Original language document was announced in IAA as A85-14322
Avail: NTIS HC A03

The use of satellite remote-sensing techniques for the vegetation mapping of arid areas is examined, and the possibilities of the direct and indirect interpretation of vegetation cover using local landscape indicators are evaluated. Particular consideration is given to relief interpretation, the interpretation of rocks and friable deposits, and the interpretation and classification of vegetation. Finally, the characteristics of field and laboratory work pertaining to the generation of pasture maps are examined. L.M. (IAA)

N86-20450# Joint Publications Research Service, Arlington, Va.
STUDY OF SPATIAL STRUCTURE OF SOIL COVER IN BAYKAL REGION USING AEROSPACE PHOTOGRAPHS Abstract Only
V. A. KUZMIN *In its* USSR Report: Space (JPRS-USP-86-002) p 67 10 Feb. 1986 Transl. into ENGLISH from Issledovaniye Zemli Iz Kosmosa (Moscow, USSR), no. 4, Jul. - Aug. 1985 p 53-57 Original language document was announced in IAA as A86-13282
Avail: NTIS HC A05

Soil cover and its changes can be studied best by using aerospace materials. It is best that soil regions be defined on photographs at 1:2,500,000. An example of a soils geography regionalization map, compiled from photographs at this scale, is illustrated. Regions are defined within the limits of plateaus, plains, high, intermediate and low mountains and basins. Photographs at 1:1,000,000 yield considerably more information; in addition to provinces and regions it is possible to define landscape units. Among the different photographic scales used the most detailed were intermediate scale photographs on which it is possible to discriminate districts soil micro- and mesostructures and elementary soil areas. In contrast to space photographs on aerial photographs it is possible to discriminate vegetation, micro- and mesorelief, and in cultivated areas such soil characteristics as humus content, moisture content, calcareousness, etc. In the study of soils geography the soil cover is reflected through the structure of different levels of organization. Author

N86-20451# Joint Publications Research Service, Arlington, Va.
RADIATION CORRECTION FOR AEROSPACE IMAGES OF AGRICULTURAL CROPS Abstract Only
A. S. BARYKIN, V. V. KOZODEROV, and V. P. POPOV *In its* USSR Report: Space (JPRS-USP-86-002) p 68-69 10 Feb. 1986 Transl. into ENGLISH from Issledovaniye Zemli Iz Kosma (Moscow, USSR), no. 4, Jul. - Aug. 1985 p 78-85 Original language document was announced in IAA as A86-13285
Avail: NTIS HC A05

The methods used to calculate radiative corrections in thematic processing of remotely-sensed agricultural images are reviewed. The effect of atmospheric turbidity on the accuracy of thematic classifications is estimated by comparing corrected and uncorrected images. A radiative correction algorithm is derived based on model estimates of radiative transfer in the atmosphere and an orthogonal polynomial approximation of outgoing radiation. It is found that the accuracy of image classifications increased when the effect of atmospheric turbidity was removed. Some examples of the processed imagery are provided. I.H.

N86-20932*# California Univ., Santa Barbara. Dept. of Geography.
CANOPY REFLECTANCE MODELING IN A TROPICAL WOODED GRASSLAND Semiannual Report
D. SIMONETT 31 Jan. 1986 5 p
(Contract NAGW-788)
(NASA-CR-176514; NAS 1.26:176514) Avail: NTIS HC A02/MF A01 CSCL 02F

A study area was selected in West Africa in order to establish a relationship between rainfall and grassland productivity, and also to provide ground measurements and support for the GIMMS investigation of the use of AVHRR vegetation index data for monitoring grassland biomass and productivity. Field data collection, image and collateral data acquisition, model development, and data analysis and processing are briefly discussed. E.R.

02

ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

Includes land use analysis, urban and metroplitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.

A86-20651*
SPATIAL INFORMATION TECHNOLOGIES FOR REMOTE SENSING TODAY AND TOMORROW; PROCEEDINGS OF THE NINTH PECORA SYMPOSIUM, SIOUX FALLS, SD, OCTOBER 2-4, 1984
Symposium sponsored by IEEE, USGS, NASA, and ASP. Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, 433 p. For individual items see A86-20652 to A86-20704.

Topics discussed at the symposium include hardware, geographic information system (GIS) implementation, processing remotely sensed data, spatial data structures, and NASA programs in remote sensing information systems. Attention is also given GIS applications, advanced techniques, artificial intelligence, graphics, spatial navigation, and classification. Papers are included on the design of computer software for geographic image processing, concepts for a global resource information system, algorithm development for spatial operators, and an application of expert systems technology to remotely sensed image analysis. V.L.

A86-20654
GEOGRAPHIC INFORMATION SYSTEMS - AN OVERVIEW
D. F. MARBLE (New York, State University, Buffalo) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 18-24. refs

This paper provides a general overview of the development of computer-based systems for spatial data handling. It examines the nature of these geographic information systems (GIS) and explores certain links in their development to developments in associated fields such as computer graphics, software engineering, and photogrammetry and remote sensing. The paper concludes with a brief enumeration of certain critical research areas and institutional developments which are felt to be necessary to insure continued, effective development of the field. Author

A86-20656* Michigan State Univ., East Lansing.
MICROCOMPUTER-BASED, STATEWIDE, DIGITAL LAND-SURFACE INFORMATION
D. P. LUSCH and W. R. ENSLIN (Michigan State University, East Lansing) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 40-43. refs
(Contract NGL-23-004-083)

The Center for Remote Sensing at Michigan State University is developing a statewide data base of land-surface information on an ERDAS 400 microcomputer system. The raster file structure uses 1 square-kilometer grid cells and contains 633 columns and 733 rows. The initial elements of this data base include (1) augmented Level I land cover; (2) average available soil water capacity; (3) topographic information; and (4) multiple-vector, windward distance to the Great Lakes. Other elements will be added to the data base in the future in order to serve the multidisciplinary needs of the research community at Michigan State University. Author

A86-20668* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CONCEPTS FOR A GLOBAL RESOURCES INFORMATION SYSTEM
F. C. BILLINGSLEY and J. L. URENA (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 123-131. NASA-supported research. refs

The objective of the Global Resources Information System (GRIS) is to establish an effective and efficient information management system to meet the data access requirements of NASA and NASA-related scientists conducting large-scale, multi-disciplinary, multi-mission scientific investigations. Using standard interfaces and operating guidelines, diverse data systems can be integrated to provide the capabilities to access and process multiple geographically dispersed data sets and to develop the necessary procedures and algorithms to derive global resource information. Author

A86-20686#
TERRAIN ELEVATION AND SURFACE FEATURE DATA DISPLAY FOR MISSION, LAND USE, AND TRAFFICABILITY PLANNING
M. B. FAINTICH, J. SIMLEY, and R. FORTSON (DMA, Washington, DC) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 278-285.

The Defense Mapping Agency produces digital data bases that describe the physical appearance of the surface of the earth. Using state-of-the-art display and analysis concepts in conjunction with sophisticated interactive computer graphic systems, a variety of geographic displays are available. These include color vector profiles, contours, and boundary plots, color raster map and analysis displays, and simulated vicual and electro-optical sensor displays. Applications include mission planning for both ground and airborne operations, trafficability based upon terrain and surface cover, and general land use and resource management. Author

A86-21101*

INTERNATIONAL SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT, 18TH, PARIS, FRANCE, OCTOBER 1-5, 1984, PROCEEDINGS. VOLUMES 1, 2, & 3

Symposium sponsored by CNES, Environmental Research Institute of Michigan, NASA, et al. Ann Arbor, MI, Environmental Research Institute of Michigan, 1985. Vol. 1, 699 p.; vol. 2, 701 p.; vol. 3, 713 p. In English and French. For individual items see A86-21102 to A86-21172, A86-21174 to A86-21273.

Papers are presented on the applications of satellite technology, such as monitoring of agriculture, appraising of natural resources, and studying disasters. Topics discussed include, advances in remote sensing processes, multisensor imaging, and mapping. Extensive consideration is given to the processing, modeling, integrating, and evaluating of satellite data. I.F.

A86-21124*# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

OHIO RIVER MAIN STEM STUDY - THE ROLE OF GEOGRAPHIC INFORMATION SYSTEMS AND REMOTE SENSING IN FLOOD DAMAGE ASSESSMENTS

H. A. EDWARDO, F. R. MOULIS (U.S. Army, Engineer District, Pittsburgh, PA), C. J. MERRY, H. L. MCKIM (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, NH), A. G. KERBER (NASA, Goddard Space Flight Center, Greenbelt, MD), and M. A. MILLER (NASA, Goddard Institute for Space Studies; Sigma Data Services Corp., New York) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 265-281. Army-sponsored research.

The Pittsburgh District, Corps of Engineers, has conducted feasibility analyses of various procedures for performing flood damage assessments along the main stem of the Ohio River. Procedures using traditional, although highly automated, techniques and those based on geographic information systems have been evaluated at a test site, the City of New Martinsville, Wetzel County, WV. The flood damage assessments of the test site developed from an automated, conventional structure-by-structure appraisal served as the ground truth data set. A geographic information system was developed for the test site which includes data on hydraulic reach, ground and reference flood elevations, and land use/cover. Damage assessments were made using land use mapping developed from an exhaustive field inspection of each tax parcel. This ground truth condition was considered to provide the best comparison of flood damages to the conventional approach. Also, four land use/cover data sets were developed from Thematic Mapper Simulator (TMS) and Landsat-4 Thematic Mapper (TM) data. One of these was also used to develop a damage assessment of the test site. This paper presents the comparative absolute and relative accuracies of land use/cover mapping and flood damage assessments, and the recommended role of geographic information systems aided by remote sensing for conducting flood damage assessments and updates along the main stem of the Ohio River. Author

A86-21125*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

REMOTE SENSING AND DISASTER MONITORING - A REVIEW OF APPLICATIONS IN INDONESIA

J. P. MALINGREAU (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 283-297. refs

The role played by remote sensors on-board the Landsat and NOAA-7 satellites in monitoring and management of three catastrophic events that took place in 1982 and 1983 in Indonesia (two major volcanic eruptions and a large-scale forest fire) is assessed. The modes of operation of the satellite platforms, the types of data derived, and data availability to the users are described, and the sources of failures and delays (such as the presence of clouds, technical and computer errors, red-tape, etc.) are examined. The major drawbacks of the Landsat-supplied information for monitoring short-lived and fast-changing events were the insufficient frequency of data acquisition, delayed delivery of data, and extended times needed for data distribution and processing. Indonesia's NOAA-7 and GMS sensors, although of low spatial resolution, offered higher frequency of data collection, and profited from the existence of a local receiving station. The present value of the space-based imagery is seen mainly in the baseline assessment of the disaster-prone areas, which can assist in preparing these areas for the impending catastrophic events. I.S.

A86-21131#

GEMS AND GRID - CLOSING THE DATA LOOP

H. CROZE, C. BOELCKE, and M. D. GWYNNE (United Nations, Nairobi, Kenya) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 355-365. refs

GEMS, the Global Environment Monitoring System, which operates both within and outside the United Nations family of organizations, has been coordinating environmental monitoring and assessment activities for nearly a decade at thousands of sites throughout the world. GEMS deals with air, water, soil and food pollution, climate and renewable natural resources, including soil degradation, tropical forests, rangelands and endangered plant and animal species. In order to make GEMS-type environmental data of maximum use to both national and regional decision making, as well as for programming international development efforts, GEMS is establishing within the UN system a global resource information database (GRID). Author

A86-21155#

STUDY OF LANDSCAPE UNITS, ECOZONES AND BIOPHYSICAL LAND USE IN FRANCE'S DROME DEPARTMENT USING LANDSAT DATA

A. BOEMARE (Drome, Conseil d'Architecture, d'Urbanisme et de l'Environnement, Valence, France) and M. LENCO (Ministere de l'Environnement, Paris, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 595-602. In French.

The target of the study was to sensitize the local authorities of the Drome department in S.E. of France to environmental problems by means of remote sensing informations and also to show the possibilities afforded by remote sensing to analyze the environmental phenomena. The study consisted in visual interpretation of a restored enhanced false color image at 1:100,000 scale which was obtained by processing of Landsat MSS data. The interpretation was digitized and provided cartographic and numerical (ha) results in administrative, geographical and watershed boundaries about ecozones, biophysical land use divided in 40 classes, and landscape units according three levels. The results were compared with other external cartographic data to undertake thematic or synthetic studies and to bring an assistance to decisions by ecozone and landscape or administrative unit for environmental problems such as conservation of wetlands, of ecological zones of interest for flora and fauna, of forests and agricultural activity, water policy, and quarries policy. Author

A86-21161#

RECENT CONTRIBUTIONS OF SATELLITE REMOTE SENSING TO THE IMPLEMENTATION OF REGIONAL ENVIRONMENTAL POLICY IN ILE DE FRANCE (PARIS REGION) THROUGH THE QUANTITATIVE MAPPING OF URBAN VEGETATION

R. DELAVIGNE and C. THIBAULT (Ile-de-France, Institut d'Amenagement et d'Urbanisme, Paris, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 675-691.

A86-21162#

POTENTIAL APPLICATIONS FOR SPOT DATA IN THE PARIS REGION FROM THE RESULTS OF 1981 AND 1983 SIMULATION STUDIES

A. BALLUT (Ile-de-France, Institut d'Amenagement et d'Urbanisme, Paris, France) and P. T. NGUYEN (IBM France, S. A., Paris, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 693-703.

Two methods of change detection using two sets of SPOT simulation data acquired on the Paris area are investigated. The first method uses the maximum likelihood to detect the land use units at two dates and the classified images are used to determine the changes. In the second the reflectance at the two dates are compared and area with radiometric changes are detected. These methods can detect area of changes of 5000 sq km and 1250 sq m respectively. The detected changes are analyzed using aerial photographs to determine the exact nature of the changes.

Author

A86-21181#

REMOTE SENSING OF URBAN CHARACTERISTICS USING A SPOT SIMULATION

L. CHARBONNEAU, R. BROCHU, D. MORIN, and F. BONN (Sherbrooke, Universite, Canada) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 961-969. refs
(Contract NSERC-A-5252)

The object of this study is to evaluate the potential of SPOT in multispectral mode for mapping urban land use. On June 10, 1982 a SPOT simulation was conducted over the city of Sherbooke by the Canada Centre for Remote Sensing using a Daedalus scanner (DS 1260). Of all the land units the most characteristic were chosen. The themes were generated from a supervised classification based on the spectral properties of urban environments. Ten land cover classes have been identified by the supervised classification process, and have been compared with an existing land use map.

Author

A86-21190#

PRODUCTION OF A NATIONAL ROAD-ATLAS IN SWEDEN BASED ON LANDSAT DATA

A. GREEN ENGBERG, S. OLOVSSON, H. OLSSON (Swedish Space Corp., Solna, Sweden), and L. SKOG (ESSELTE Map Service, Stockholm, Sweden) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1075-1079.

In a joint project, the Swedish Space Corporation has provided ESSELTE Map Service with geometrically corrected and classified digital Landsat MSS information. The satellite information has been combined with digital cartographic data, and final films for printing color maps have been output on a laser plotter. A national coverage at the scale of 1:200,000 of printed maps with satellite and digital cartographic data will introduce a new concept to Swedish map consumers.

Author

A86-21191#

THE USE OF SATELLITE IMAGES IN THE STUDY OF URBAN ENVIRONMENT AND AS A GUIDELINE IN CITY PLANNING

M. LOMBARDO and J. R. TARIFA (Sao Paulo, Universidade, Brazil) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1091-1099. refs

In this study, an attempt was made to verify the alteration of the urban environment by the utilization of satelltie images and data of pollution. The integration of the interpretation of the Landsat data mapping the use of urban soil and of thermal images from the meteorological satellite in the analysis of temperature variations associated with the pollution data helped in the identification of areas with the most problems of environment degradation.

Author

A86-21198#

THE USES OF SATELLITE IMAGERY FOR THE PLANNING AND MANAGEMENT OF RURAL DEVELOPMENT PROJECTS

N. P. FREELAND (Masdar Technology, Ltd., Wokingham, England) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1167-1176.

A86-21211#

TRIAL APPLICATION OF SPACE REMOTE SENSING AS AN AID TO IMPACT ASSESSMENT OF MAJOR LINEAR INFRASTRUCTURE WORKS

M. LENCO (Ministere de l'Environnement, Paris, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1353-1370. refs

One of the applications considered is related to the identification of zones of minimum impact for the proposed Lannemezan Zaragoza EHT (extremely high voltage) power line between southwest France and Spain. Another application involves an assessment of the impact of the proposed 'Atlantic' route for the French TGV (high speed train) project. Each of the two investigations conducted involved the use of restored enhanced false color images which covered the entire length of the considered linear structure. The employed images had been obtained on the basis of Landsat 2 data. The analysis discussed had the objective to obtain up-to-date information regarding the effect of the proposed routes on the environment, giving particular attention to critical areas.

G.R.

A86-21226#

SHAPE-ASSISTED LAND-USE CLASSIFICATION FOR REMOTELY SENSED DATA

K. C. CLARKE (Hunter College, New York) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1517-1525. Research supported by the City University of New York. refs

This study investigates the feasibility of incorporating quantitative information about land-use area shape into the land-use classification process. Previous approaches to land-use classification from remotely sensed data have relied almost entirely upon spectral properties of the land surface cover alone. Part of the United States Geological Survey 1:250,000 land-use series map for Cape Cod, Massachusetts was digitized and used to calculate fourteen vector-based shape measures. Of these, nine were used to analyze the shapes of the land-use areas, both individually and collectively using principal components analysis. Some links between spatial shape and land-use were noted, but the size of the data set and the range of the land-uses chosen was not sufficient to draw further conclusions. Extensions of the use of shape logic in the land-use classification process were considered, including the use of raster-based shape measures. The author proposes that a shape-based set of classification procedures be developed, to assist the spectral techniques currently in use.

Author

A86-21236#

CONTRIBUTION OF SATELLITE IMAGERY FOR THE STUDY OF FRANCE'S REGIONAL NATURAL PARKS

J.-P. DEDIEU (Societe Francaise d'Etudes et de Recherches Economiques et Statistiques, Chambery, France) and M. LENCO (Secretariat d'Etat et a l'Environnement et a l'Environnement et a la Qualite de la Vie, Neuilly-sur-Seine, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1629-1642. In French.

The usefulness of Landsat images as a source of information concerning France's regional natural parks is noted, and it is pointed out that the areal extent of these geographic areas makes them well-suited for Landsat studies at 1/100,000 scale. Landsat images of the parks provide a homogeneous data set that may be economically updated for the different ecozones and biophysical land use units present within the park boundaries. Examples of interpretation are given for the Parc du Vercors, the Parc du Jura Gessien (planned), and the Parc du Morvan. D.H.

A86-21238#

APPLICATION OF SATELLITE REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS TO THE MANAGEMENT OF NATURAL RESOURCES

R. MANIERE (Nice, Universite, France), A. GIRAUD (Paris, Ecole Nationale Superieure des Mines, Valbonne, France), and J. CLAUDIN (Service d'Interpretation du Milieu Naturel, Nice, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1659-1669. CNRS-supported research. refs

A geographic information system on the environment has been set up and tested within the framework of a multi-disciplinary program financed jointly by the National Space Research Center (CNRS) and the Provence-Alpes-Cote d'Azur regional authority. The study area is the Mercantour National Park. The main aspects of the study are the creation of a geocoded database covering the main descriptors of the environment, including a digital terrain model, and the use of satellite data (Landsat, HOMM, SPOT Simulation). The goal is improved management of rural areas in medium and high mountain ranges. D.H.

A86-21241#

SATELLITE IMAGERY FOR ROAD PROJECT

G. CHAMPETIER DE RIBES (Laboratoire Central des Ponts et Chaussees, Paris, France) and M. DORIDOT (Laboratoire Regional de l'Est Parisien, Paris, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1689-1691.

Data from Landsat 1, 2 and 3 have been used to advantage in connection with road alignment studies in Niger and Zaire. Careful analysis of the drainage pattern, the indirect consequences of this analysis on the morphological and geological characteristics of the region, and potential sources of construction materials are a few of the themes to which these new remote sensing technques can most profitably be applied. All results acquired in the course of these researches are combined in a methodological framework of which the broad outlines are described. Author

A86-21266#

INFLUENCE OF SNOW COVER RECESSION ON AN ALPINE ECOLOGICAL SYSTEM

M. KELLER and K. SEIDEL (Zuerich, Eidgenoessische Technische Hochschule, Switzerland) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1931-1936. SNSF-supported research. refs

A study of high Alpine regions is being conducted as part of the worldwide UNESCO program 'Man and Biosphere (MAB)' which is examining the mutual effects of economic activities, land use, and natural resources. At test site MAB-Davos, virtually all available data on climate, forestry, game biology, landscape history, soil science, vegetation, and human activities have been assembled into a Geographical Information System (GIS). For a period in 1981, a set of snow cover distribution maps has been derived using Landsat-MSS imagery. The quantitative comparison of the snow cover recession with certain GIS-layers stimulates a better understanding of natural processes and interactions. D.H.

A86-22557

ASPECTS OF RAILROAD PLANNING IN COMPLEX ENVIRONMENTAL CONDITIONS USING SPACE IMAGERY [NEKOTORYE ASPEKTY PROEKTIROVANIIA ZHELEZNYKH DOROG V SLOZHNYKH PRIRODNYKH USLOVIIAKH S ISPOL'ZOVANIEM MATERIALOV S'EMOK]

A. I. BOGDANOV (Moskovskii Institut Inzhenerov Zheleznodorozhnogo Transporta, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Sept.-Oct. 1985, p. 58-60. In Russian.

A86-22649

ESTIMATING URBAN VEGETATION COVER IN LOS ANGELES

D. E. BROWN and A. M. WINER (California, University, Riverside) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, Jan. 1986, p. 117-123. Research supported by the California Air Resources Board. refs

Urban vegetation in the Los Angeles basin was analyzed as part of an investigation to estimate hydrocarbon emissions from leaf mass, and to assess the potential contribution of such emissions to photochemical air pollution. A positive print mosaic of NASA U-2 color infrared photographs (taken in 1972) was used for regional delineation of broad vegetation land-use categories. Urban areas were additionally subdivided into sampling polygons. Randomly selected cells within 20 defined polygons were photographed in 1982 by a low altitude flight (1:3,000) with color infrared film. Vegetation was mapped and digitized for cover by a physiognomic classification which included trees, palm trees, shrubs, ground cover, and grasses. Urban vegetation cover ranged from about 4 percent to 58 percent for the sites sampled, with an average value of 27 percent. Field teams obtained vegetation cover and biomass data for the sample sites. Integration of the photography and field data provided leaf mass estimates for each vegetation class. Author

A86-22723

MONITORING AND SURVEILLANCE OF THE EUROPEAN ENVIRONMENT WITH THE NOAA-AVHRR (DIGITAL) SATELLITE [ERFORSCHUNG - OBERWACHUNG DER EUROPAEISCHEN UMWELT MIT NOAA-AVHRR (DIGITAL) SATELLITENDATEN]

H. KAMINSKI (Bochum, Sternwarte, West Germany) IN: European Telemetry Conference, 7th, Boeblingen, West Germany, May 21-24, 1984, Reports. Part 2 . Wessling, West Germany, Arbeitskreis Telemetrie, 1984, p. 8.1-8.1.18. In German. refs

During the last few decades, Europe has to cope with environmental problems of increasing severity. These problems can be divided into three main categories. One is related to bad environmental conditions in the case of rivers, coasts, and interior large bodies of water, such as the Baltic Sea. Another category of problems is concerned with the pollution of the atmosphere, while the third category includes problems affecting the land surface of Europe. For an objective description of the environmental situation, it is necessary to determine the existing conditions on the basis of a large-area diagnosis. Earth satellites, unmanned or manned, appear particularly suited for obtaining the required data. The satellites which are best suited include the NOAA satellites, the Landsat satellites, the Nimbus satellites, and the Space Shuttle with Spacelab. G.R

A86-22834

PRELIMINARY EVALUATION OF SIMULATED SPOT DATA FOR CULTURAL RESOURCE ASSESSMENT - AN EXPERIMENT AT BANDELIER NATIONAL MONUMENT, NEW MEXICO

M. INGLIS, T. K. BUDGE (New Mexico, University, Albuquerque), and J. I. EBERT IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 73-82. refs

Multispectral scanner data, especially when used in concert with aerial photographs and other remote sensor data sources, have been illustrated to have promise as input to sampling designs, assessments, and predictive models directed toward cultural resources. While experiments in the actual discovery of archeological sites and other cultural resources using Landsat data have recently been reported, the use of simulated three channel 20m SPOT data in this paper will focus less on the potential for actually detecting site signatures as upon the modeling of (1) characteristics of the natural environment that might be useful in predicting the location and nature of past human activities and thus the remains resulting from these activities; and (2) the recognition and measurement of natural, primarily surface, or immediately subsurface geomorphological processes responsible for the deposition of archaeological materials and their post-depositional preservation or alteration. Author

A86-22841

COMPARATIVE EVALUATION OF SIMULATION SPOT, LANDSAT-TM AND NHAP CIR DATA FOR URBAN LAND COVER AND IMPERVIOUS SURFACE IDENTIFICATION

M. G. DOLAN, S. R. MARTIN (Regional Planning Council, Baltimore, MD), and L. J. WARNICK (Earth Satellite Corp., Chevy Chase, MD) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 148-156.

The Regional Planning Council (RPC) is an areawide planning agency, covering the City of Baltimore, Maryland, and its metropolitan area. The RPC provides information and conducts analyses for both local and state governments in the areas of land use/land cover, water quality, air quality, transportation, housing, economics, and other areas. Remote sensing tools and methods can assist the RPC in the performance of its function. However, the potential applicability of Landsat-TM and future SPOT-type data, with spatial resolutions ranging from 10 m to 30 m, is not clearly established. In an attempt to obtain some information regarding such an applicability, RPC is conducting a series of analyses of NHAP CIR, Landsat-TM, and simulated SPOT data. Some preliminary conclusions are discussed. It is found that NAHP CIR at 1:58,000 is superior to either SPOT-type or TM resolution data for first-time mapping of land use/land cover at the level of detail desired by the local governments. G.R.

A86-22843* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

INVESTIGATION OF SPOT SPECTRAL CHARACTERISTICS FOR DISCRIMINATING LAND USE AND LAND COVER IN PRINCE GEORGE'S COUNTY, MARYLAND

D. L. TOLL (NASA, Goddard Space Flight Center, Greenbelt, MD) and R. E. KENNARD (Science Applications Research, Riverdale, MD) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 165-170.

A86-22845

APPLICATIONS OF SIMULATED SPOT DATA TO MAPPING LAND COVER PATTERNS AND CHANGES IN AN URBAN FRINGE ENVIRONMENT

V. A. MILAZZO and R. H. DEANGELIS (USGS, National Mapping Div., Reston, VA) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 177-186. refs

Applications to geographic and cartographic research of simulated multispectral data, as anticipated from the SPOT satellite, are being investigated. One area of this research focuses on assessing the system's potential, particularly in terms of its increased spatial resolution, for use in the compilation, inspection, and (or) revision of certain thematic and planimetric map data currently derived from high-resolution aerial photographs. In this study, simulated SPOT data, in both image and digital formats, are being analyzed with respect to the classification and mapping of land use and land cover and the detection of change within an urban fringe environment. Preliminary findings indicate that the higher spatial resolution of the multispectral digital image product yields a level and accuracy of data appropriate for certain small-scale (1:250,000) and, in some cases, intermediate (1:100,000) to large-scale (1:24,000) mapping applications. Investigations involving computer-aided classification of the digital data are ongoing, but preliminary analyses indicate that the higher spatial resolution of SPOT data holds fewer advantages when using machine processing rather than visual interpretation techniques. Author

A86-24617

A SMALL SCALE REGIONAL ANALYSIS FROM PHOTOGRAPHS TAKEN WITH THE SPACELAB METRIC CAMERA - BOTANICAL AND PEDOLOGICAL APPROACH [INTERPRETATION DU PAYSAGE A PETITE ECHELLE A PARTIR DE CLICHES DE LA CHAMBRE METRIQUE SPACELAB - APPROCHE BOTANIQUE ET PEDOLOGIQUE]

C. M. GIRARD and M. C. GIRARD (Institut National Agronomique, Paris, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 99, 1985, p. 41-51. In French. refs

The Spacelab-1 metric camera was used to obtain stereoscopic views of the northwest region of France with a one square hectare resolution at a scale of 1:820,000. The data were treated in terms of the geomorphology, hydrologic networks, land use and the sizes of differentiated parcels. Interpretations were performed as functions of constant brightness, the similarities of structure and the organizations of the countryside, and the farmed land. Farm sectors were further broken down by geomorphology, the drainage patterns and the types of soil use. The data, revealing associations between crop vigor and the soil types and geomorphology, can lead to better land management. Specific examples are provided of interpretations of the metric camera data to identify the vegetal types which grow on different soil types on plateaus, slopes, plains and alluvial systems. M.S.K.

A86-24618

AN ANALYSIS OF THE INFORMATION CONTENT OF PHOTOGRAPHY CARRIED OUT ON SPACELAB-1 - APPLICATION TO LAND MANAGEMENT STUDIES [ANALYSE DU NIVEAU D'INFORMATIONS RECUEILLIES A PARTIR DES PHOTOGRAPHIES DE SPACELAB-1 - APPLICATION AUX ETUDES D'AMENAGEMENT]

J.-L. PELLETIER (Laboratoire Regional de l'Est Parisien, Melun, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 99, 1985, p. 53-64. In French.

The information content of the panchromatic photographs obtained on the Spacelab-1 mission was assessed to determine their usefulness. The photographs were taken at a solar zenith angle of 15 deg at a scale of 1:810,000, yielding a swath 185 km across. Stereoscopic views were formed using two photographs taken 5 sec apart. Further refinement of the images enhanced the resolution to 1:100,000 and 1:50,000, i.e., scales employed for civil engineering. The images selected were of the region northeast of Avignon. Attention was given to the imagery contents such as lineaments, geological units, structural units, land use patterns and the organization of the countryside. The photographs, using high quality emulsions, were concluded to yield useful data on scales ranging from 1:500,000 to 1:50,000. It is noted that the images would be of particular use in regions targeted for development. M.S.K.

A86-25594
ANTHROPOGENIC EFFECTS ON THE ENVIRONMENTS ACCORDING TO OBSERVATIONS FROM SPACE [ANTROPOGENNYE VOZDEISTVIIA NA PRIRODNUIU SREDU PO NABLIUDENIIAM IZ KOSMOSA]
A. A. GRIGOREV Leningrad, Izdatel'stvo Nauka, 1985, 240 p. In Russian. refs

Remote-sensing concerning many regional and planetary-scale disruptions of the environment are presented. Harmful effects of human activity in the hydrosphere, lithosphere, atmosphere, and biosphere are described. The use of data supplied by Landsat, Salyut, and other spacecraft in the evaluation of conditions and development of land use and of changes effected by the activity of large cities on the environment is discussed. Consideration is given to major environmental transformations that have occurred in Sahel, the Aral Sea area, and Vietnam. International aspects of satellite-based monitoring of the global ecosystems are also considered. I.S.

A86-28590
ENVIRONMENT RELATED COOPERATION
J. BRETON (CNES, Toulouse, France) IN: Europe/United States space activities . San Diego, CA, Univelt, Inc., 1985, p. 251-262.
(AAS 85-132)

The role of the French Centre National d'Etudes Spatiales (CNES) in developing environmental monitoring satellites for navigational applications is discussed. A review of the history of remote sensing and environmental monitoring projects at CNES is given, with reference made to the D1, EOLE, French Starlet, and ARGOS satellite programs. The data acquisition and localization operations of the current generation of ARGOS satellites (ARGOS-2), are described in detail. Attention is given to the reduction in throughput time which has been achieved in current ARGOS systems due to their enhanced ground segment data processing capability. The design of a 406-MHz satellite system for the SARSAT network, which is based on the ARGOS-2 satellite is also described, and the possibility of using geosynchronous satellite to detect distress emissions from ships at sea is briefly considered. A map showing the ground stations in the SARSAT network is provided. I.H.

A86-29402
EDUCATION IN ENVIRONMENTAL REMOTE SENSING - A BIBLIOGRAPHY AND CHARACTERIZATION OF DOCTORAL DISSERTATIONS
R. W. MERIDETH, JR. and A. B. SACKS (Wisconsin, University, Madison) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, March 1986, p. 349-365. refs

N86-17815*# Murray State Univ., Ky. Mid-America Remote Sensing Center.
DETERMINATION OF THE UTILITY OF REMOTE SENSING DATA FOR LAND USE/COVER ANALYSIS IN THE LOWER APPALACHIA REGION: ASSESSING THE UTILITY OF REMOTE SENSING DATA FOR ARCHEOLOGICAL SITE RECOGNITION Final Report
N. V. WEBER 15 Aug. 1983 48 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS13-200)
(E86-10021; NASA-CR-176435; NAS 1.26:176435) Avail: NTIS HC A03/MF A01 CSCL 05B

Thematic Mapper Simulator (TMS) data were gathered by NASA/ERL over a portion of the lower Ohio River and the middle Mississippi River valleys on April 11, 1982. CIR imagery accompanied the 10 and 30 meter resolution TMS data sets. This area is somewhat unique archeologically as there exists a concentration of sites with major features such as mounds, earthworks, and villages. It was the primary purpose of this study to determine the utility of TMS data in identifying signatures which are distinctly archeological. TMS data were processed using the NASA/ERL software package ELAS. No signatures that were distinctly archeological were detected, due in large part to the complexity of the land cover and land use practices. However, as more sophisticated classification techniques were employed, the classes which were related to archeological features were narrowed. TMS data could certainly be of assistance to a trained archeologist/interpreter in narrowing an area which has to be field-surveyed as anomalous features can be recognized within a particular environmental context. Author

N86-18369# Exmoor National Park Dept., Dulverton (England).
REMOTE SENSING FOR ENVIRONMENTAL MANAGEMENT OF BRITISH NATIONAL PARKS: REVIEW AND PREVIEW
L. F. CURTIS *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 107-114 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

Land cover maps and environmental quality assessment in National Parks in England and Wales are discussed. Remote sensing platforms used include autogyros, aircraft, and satellites. The role of color and infrared color photography increased. The development of image analysis of Multispectral Scanner (MSS) and Thematic Mapper (TM) data results in a major improvement in the operational capability of satellite data. The use of ratio (vegetation index) and image enhancement techniques for Exmoor National Park is described and work in other National Parks is reviewed. Proposals for further studies include comparative studies using MSS, TM and SPOT data. Author (ESA)

N86-20980# European Space Agency, Paris (France).
DFVLR MEASURING SYSTEM FOR THE DETERMINATION OF THE SPATIAL DISTRIBUTION OF ENVIRONMENTAL PARAMETERS OF THE ATMOSPHERE BY MEANS OF MOBILE INSTRUMENTED PLATFORMS
D. PAFFRATH Aug. 1985 73 p refs Transl. into ENGLISH of "DFVLR-Messsystem zur Erfassung der raeumlichen Verteilung von Umweltparametern in der Atmosphaere mit mobilen Messtraegern" Rept. DFVLR-FB-85-09 Oberpfaffenhofen, West Germany, Dec. 1984 Original report in GERMAN previously announced as N85-26472
(ESA-TT-924; DFVLR-FB-85-09) Avail: NTIS HC A05/MF A01; original German version available from DFVLR, Cologne DM 21

Mobile measuring platforms and measurement methods for the quantitative determination of the spatial distribution of air pollution concentration and of meteorological parameters are described. The measuring instruments are installed in a twin-engined airplane for environmental research, in three vector gliders for acquisition of meteorological parameters, in a van for measuring aerosol and air pollution, and in a lidar system container for determination of the horizontal and vertical aerosol distribution. Author (ESA)

N86-21967 Stanford Univ., Calif.

SPATIAL CLASSIFICATION OF URBAN LANDSCAPES FROM LANDCOVER PROBABILITIES DERIVED THROUGH REMOTE SENSING Ph.D. Thesis

E. C. DRISCOLL, JR. 1985 172 p

Avail: Univ. Microfilms Order No. DA8522134

A technique for classification of urban landuses from remotely sensed data such as aerial photographs is presented. Simulating the behavior of a human airphoto interpreter, it uses a two-stage approach, recognizing first landcover and then landuse. In the first stage, a straightforward multispectral classification technique is used to generate probability maps for a set of urban landcovers, e.g., grass, trees, asphalt, concrete, and shadow. Then the spatial nature of these landcover probabilities is examined and landuses are predicted based on neighborhood landcover mix and structure. Varying neighborhood sizes are explored. The algorithm is tested on a large urban dataset of Palo Alto California, obtained by scanning a high altitude, infrared, aerial photograph to an effective resolution of 1.5 meters. Dissert. Abstr.

03

GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A86-21107#

APPLICATION OF SPOT AND D.T.M. TO CARTOGRAPHY

A. BAUDOIN (Institut Geographique National, Saint-Mande, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 61-74. refs

SPOT could be a very useful tool to cartographers with its high resolution sensors and its stereoscopic capabilities. SPOT images and Digital Terrain Models will be merged or derived from one to another in order to produce new geographical data. Stereo pairs and multi-incidence observations will be used to generate a ground control points network and digital terrain models where basic maps are missing. Optical and digital equipments have both their advantages to process SPOT images. When a D.T.M. already exists it could be used to rectify a vertical or oblique view, even in mountainous areas, with a high cartographic accuracy (10 m). It could be used also to generate stereo-ortho images in order to get a 3 D spacemap. Merging SPOT images with a D.T.M. or derived products (slopes, sun illumination) could be very useful to get a better classification of an image: especially in mountaineous areas where spectral signatures of vegetation depends on the sun illumination conditions. The classification should be improved using multi-incidence observations. In order to be able to merge all these images and data, geocoded data bases will be developed. They will give the opportunity to the user to get a map, which is more accurate and up to date, and easier to use. Author

A86-26347

ADVANCES IN GEOPHYSICS. VOLUME 26

B. SALTZMAN, ED. (Yale University, New Haven, CT) Orlando, FL, Academic Press, Inc., 1984, 357 p. For individual items see A86-26348 to A86-26350.

Papers are presented on the structure of the inner and outer cores and the lower mantle, and on climate model simulations of CO2-induced climatic changes. Topics discussed include prepleistocene paleoclimates, geological and paleontological evidence, and the modeling strategies and boundary conditions for paleoclimates. Consideration is given to the retrieval of precipitation and other geophysical parameters using satellite microwave systems. I.F.

A86-26425

ON UTILITY OF SPACE-BORNE VECTOR MAGNETIC MEASUREMENTS IN CRUSTAL STUDIES

A. K. AGARWAL, B. P. SINGH, R. G. RASTOGI, and S. SRINIVASAN (Indian Institute of Geomagnetism, Bombay, India) Physics of the Earth and Planetary Interiors (ISSN 0031-9201), vol. 41, Jan. 31, 1986, p. 260-268. refs

Satellite magnetic field data over India are examined in order to determine the usefulness of vector magnetic measurements in crustal studies. The procedures for isolating components of crustal origin from the magnetic field data in order to develop an anomaly map are described. The generated maps for B, X, Y, and Z fields are compared with the anomaly map of the Indian region by Langel et al. (1982b). The generated maps exhibit better resolution than the maps of Langel et al. and display features associated with the Indian Ocean geoid low. The internal consistency of the reduction technique is evaluated by comparing three vector B maps with a map derived from direct measurements; good correlation is observed demonstrating the applicability of the maps to crustal studies. I.F.

A86-29433#

THE SATELLITE DERIVED GEOID FOR SCANDINAVIA AND THE ARCTIC REGIONS - CRUSTAL STRUCTURE, LAND UPLIFT AND PLATE TECTONIC INFLUENCE

A. J. ANDERSON and F. PENG (Uppsala, Universitet, Sweden) IN: International Symposium on Space Techniques for Geodynamics, Sopron, Hungary, July 9-13, 1984, Proceedings. Volume 1 . Sopron, Hungary, Magyar Tudomanyos Akademia Geodeziai es Geofizikai Kutato Intezet, 1984, p. 101-120. refs

A86-29439#

A COMPARISON OF CEI, VLBI, BIH AND USNO EARTH ORIENTATION INFORMATION

D. D. MCCARTHY, A. K. BABCOCK, and D. N. MATSAKIS (U.S. Naval Observatory, Washington, DC) IN: International Symposium on Space Techniques for Geodynamics, Sopron, Hungary, July 9-13, 1984, Proceedings. Volume 1 . Sopron, Hungary, Magyar Tudomanyos Akademia Geodeziai es Geofizikai Kutato Intezet, 1984, p. 199-213.

Two radio astrometric techniques used to determine the earth's orientation in space are examined. Comparisons are made of the earth orientation information obtained by the connected-element interferometry (CEI) method and the very long baseline interferometry (VLBI) methods against the standard data sets of the U.S. Naval Observatory (USNO) and the Bureau International de l'Heure, and the two sets themselves are intercompared. The analysis shows that in the polar coordinates the USNO and BIH have nearly the same accuracy. The VLBI data, from the National Geodetic Survey's Project Polaris, show degraded accuracy in x, and there are too few independent determinations in y by Polaris to analyze them properly. Good agreement is seen between the USNO and Polaris residuals in UT1-UTC, indicating that the BIH is too heavily smoothed and fails to account for rapid changes (on the order of a few weeks) in the earth's rate of rotation. The major contributor to the USNO UT1-UTC is the connected element interferometer. It is imperative that the present sources continue to be available to USNO for input to the system, and highly desirable that additional high-precision, reliable sources be added. D.H.

A86-29451#

CONTINENTAL SCALE BASELINES DETERMINED BY VLBI

D. S. ROBERTSON and W. E. CARTER (NOAA, National Geodetic Survey, Rockville, MD) IN: International Symposium on Space Techniques for Geodynamics, Sopron, Hungary, July 9-13, 1984, Proceedings. Volume 2 . Sopron, Hungary, Magyar Tudomanyos Akademia Geodeziai es Geofizikai Kutato Intezet, 1984, p. 17-24.

An account is given of very-long-baseline-interferometry (VLBI) observations made by the IRIS (International Radio Interferometric Surveying) project to monitor polar motion and earth rotation. Such observations have been made since the beginning of 1984 every five days, using the three POLARIS Stations in the United States and the Wettzell Observatory in the Federal Republic of Germany

(Carter & Robinson, 1984). The Onsala Space Observatory in Sweden has also participated about once a month. These observations demonstrate that geodetic VLBI, using the MARK III system, routinely achieves a repeatibility (RMS) on baselines ranging from 2000 to 800 km of about one part in 10 to the 8th from observing sessions of 24 hr duration. D.H.

A86-29452#
BASELINE OBSERVATIONS USING A TRIANGLE OF SATELLITES
H. DREWES (Deutsches Geodaetisches Forschungsinstitut, Munich, West Germany) IN: International Symposium on Space Techniques for Geodynamics, Sopron, Hungary, July 9-13, 1984, Proceedings. Volume 2 . Sopron, Hungary, Magyar Tudomanyos Akademia Geodeziai es Geofizikai Kutato Intezet, 1984, p. 25-32.

Reflections are presented on a satellite system which allows instantaneous measurements of the baselength between two terrestrial stations for real time surveying of high precision baseline determinations for geodynamic research. The capability of such a system is studied for two typical application fields: (1) surveying of first-order control networks (continental networks) or monitoring recent crustal movements (maximum baselength of some 100 km) and (2) worldwide surveying of global networks or geodynamic research (plate kinematics). The system is baed on purely geometrical mode and provides accuracies of the length of the baselines at the centimeter level after one pass observation time (a few minutes). Its major advantage is that precise orbit determination is not necessary - which at the outset excludes error sources such as gravity field, drag, polar motion, and other orbit-dependent effects. D.H.

N86-18861# Analytic Sciences Corp., Reading, Mass.
ANALYSIS AND SIMULATION OF MULTISENSOR GRAVITY SURVEYS: VOLUME 1 Final Report, Jun. 1977 - Mar. 1981
J. D. GOLDSTEIN 15 Apr. 1985 171 p
(Contract F19628-77-C-0152)
(AD-A160388; TR-4423-4; AFGL-TR-81-0018(1)) Avail: NTIS HC A08/MF A01 CSCL 08E

A new general methodology is developed for the determination of the statistics of multisensor survey residual gravity. The method is ideally suited for the design of multisensor surveys to achieve a desired level of gravity recovery accuracy. Survey types considered consist of any combination of satellite radar altimetry, high-low satellite-to-satellite tracking, shipborne or land-based gravimetry and airborne gravimetry. Several examples of the results obtained with the methodology are included. Author (GRA)

N86-19708 New South Wales Univ., Kensington (Australia). School of Surveying.
THE COMBINATION OF VLBI AND GROUND DATA FOR GEODESY AND GEOPHYSICS Ph.D. Thesis Abstract Only
B. R. HARVEY Feb. 1985 2 p
Avail: Issuing Activity

An analytical procedure for the combination of VLBI and geodetic survey measurements and their evaluation and comparison was developed. Crustal deformation analysis, comparisons between space techniques, and the strengthening of geodetic networks are the main applications. The VLBI analysis is reviewed and the variance covariance matrix of the observables is investigated. The effects of systematic errors, particularly biases in the tropospheric corrections, on VLBI results are investigated and classified. The results of the first geodetic VLBI experiment within Australia are presented and their accuracies estimated. A method which combines VLBI and ground data by estimating the transformation parameters relating the preadjusted coordinates of the points of each network is recommended. Methods for studying regional strain are discussed. Several models for 2D and 3D strain are examined. It is recommended that VLBI and ground data be combined at each epoch. Any strain detected is not due to crustal movements. If no significant strain is detected, then the geophysical strain between these epochs can be determined. E.A.K.

N86-19710 New South Wales Univ., Kensington (Australia).
INTEGRATION OF DOPPLER POSITIONING INTO THE GEODETIC NETWORK OF INDONESIA Abstract Only
C. HAFIDIN 1984 3 p
Avail: Issuing Activity

The Doppler satellite terrestrial coordinate determination was used to establish large control networks and reinforcing existing networks of horizontal control surveys. The preliminary network of Sumatra, Jawa and Nusa Tenggara consists of 407 stations of basically first and second order triangulation. Seventeen Doppler positions are distributed over the network. The preliminary combined adjustments of the Sumatra, Jawa and Nusa Tenggara primary horizontal networks were tested. The adjustments were carried out using the program CHAOS and the method for adjusting networks in sections. This method is mathematically similar to the Helmert block adjustment. The transformation parameters, from the Doppler System (WGS-72) into the terrestrial system (GRS-67) were determined using the PARM program, which follows the Bursa model transformation. The adjusting and transformation results are analyzed and Systematic differences between Doppler and terrestrial networks are noted. E.A.K.

N86-21968*# Southern Methodist Univ., Dallas, Tex. Dept. of Geological Sciences.
CONSTRAINTS ON LITHOSPHERIC STRUCTURE FROM SATELLITE POTENTIAL FIELD DATA: AFRICA AND ASIA. ANALYSIS AND INTERPRETATION OF MAGSAT ANOMALIES OVER NORTH AFRICA Final Technical Report, 1 Mar. 1983 - 31 May 1985
R. J. PHILLIPS 1986 104 p refs
(Contract NAG5-298)
(NASA-CR-176611; NAS 1.26:176611) Avail: NTIS HC A06/MF A01 CSCL 08G

Crustal anomaly detection with MAGSAT data is frustrated by the inherent resolving power of the data and by contamination from the external and core fields. The quality of the data might be tested by modeling specific tectonic features which produce anomalies that fall within the proposed resolution and crustal amplitude capabilities of the MAGSAT fields. To test this hypothesis, the north African hotspots associated with Ahaggar, Tibestia and Darfur have been modeled as magnetic induction anomalies due solely to shallower depth to the Curie isotherm surface beneath these features. The MAGSAT data were reduced by subtracting the external and core fields to isolate the scalar and vertical component crustal signals. The predicted model magnetic signal arising from the surface topography of the uplift and the Curie isotherm surface was calculated at MAGSAT altitudes by the Fourier transform technique modified to allow for variable magnetization. In summary it is suggested that the region beneath Ahaggar is associated with a strong thermal anomaly and the predicted anomaly best fits the associated MAGSAT anomaly if the African plate is moving in a northeasterly direction. Author

04

GEOLOGY AND MINERAL RESOURCES

Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology.

A86-19495
SYNERGISTIC VALUE OF INTERPRETING IMAGERY OF VARIOUS SCALES FOR OIL AND MINERAL EXPLORATION
L. E. BOGART (Geological and Exploration Associates, Port Townsend, WA) and L. A. READDY (Geological and Exploration Associates, Kirkland, WA) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 34-42. refs

A86-19496

SATELLITE REMOTE SENSING FOR ALUMINUM AND NICKEL LATERITES

F. B. HENDERSON, III (Geosat Committee, San Francisco, CA), G. T. PENFIELD (Western Geophysical Company of America, Aero Service Div., Houston, TX), and D. K. GRUBBS (Aluminum Company of America, Alcoa Center, PA) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 43-51. Research supported by the Aluminum Company of America and Western Geophysical Company of America. refs

The use of Landsat Thematic Mapper (TM) data to explore for aluminum and nickel laterites is discussed. Nickel laterites on Gas Island, Indonesia are defined by MSS imagery. In addition, satellite imagery of the Cape Bougainville and the Darling range, Australia bauxite deposits shows the potential use of MSS data for exploration and mining applications. Examples of satellite SAR data for Jamaica are found to document the use of this method for bauxite exploration. Finally, attention is given to the combination of TM data with SPOT satellite data and SAR data to assist with the logistics, mine development, and environmental concerns connected with aluminum and nickel lateritic deposits worldwide. B.J.

A86-19497

THE LEELANAU, BENZIE AND GRAND TRAVERSE, MICHIGAN ANOMALIES STRUCTURAL AND GEOBOTANICAL INDICATORS OF HYDROCARBON MICROSEEPAGE

R. J. STASKOWSKI (Earth Satellite Corp., Chevy Chase, MD) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 52-60. refs

The paper examines relationships between structural and geobotanical anomalies observed on Landsat and Seasat imagery and believed to be related to hydrocarbon microseepage and previously recorded subsurface geophysical, stratigraphic, and structural anomalies. The integration of these surface anomalies with regional cross sections and geophysical studies show that they lie along predictable subsurface trends. These trends control hydrocarbon migration and accumulation; anomalies occur in both producing and untested portions of the trends. It is noted that, while the proposed approach does not define specific exploration targets, it does provide an excellent regional perspective and helps to narrow-down prospective areas. B.J.

A86-20690#

THE APPLICATION OF SPATIAL INFORMATION TECHNOLOGY TO PETROLEUM RESOURCE ASSESSMENT ANALYSIS

B. M. MILLER and M. A. DOMARATZ (USGS, National Center, Reston, VA) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 303-310. refs

Petroleum resource assessment procedures require the analysis of a large volume of spatial data. The U.S. Geological Survey (USGS) has developed and applied spatial information handling procedures and digital cartographic techniques to a recent study on the assessment of oil and gas resource potential for 74 million acres of designed and proposed Wilderness Lands in the Western United States. A method was designed to expedite the gathering, integrating, managing, manipulating and plotting of spatial data from multiple data sources that are essential in modern resource assessment procedures. Author

A86-20695

IMAGE PROCESSING FOR DATA INTEGRATION IN MINERAL AND PETROLEUM EXPLORATION

S. ARONOFF and D. HAWKINS (Dipix Systems, Ltd., Ottawa, Canada) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 346-356.

Successful mineral and petroleum exploration requires that diverse data be effectively integrated. Multi-million dollar exploration programs depend on the ability of exploration geologists to analyze interrelated data sets and recognize sites sufficiently promising to justify investment in more detailed surveys or exploratory drilling. The power and speed of an image processing system to manipulate data sets allows the geologist the time to progressively refine an analysis. These techniques are illustrated using two examples. In Example One, Landsat digital data, geochemical, and aeromagnetic data for the Nabesna area of Alaska is integrated with existing maps. Example Two shows data integration applied to the interpretation of seismic data. Author

A86-20702#

MONITORING FEDERAL MINERALS WITH THE USE OF LANDSAT ALBEDO DIFFERENCE AND ANCILLARY DATA

R. E. ARNDT (U.S. Bureau of Land Management, Washington, DC) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 406-408.

BLM utilizes Landsat data together with a multilayered GIS to monitor changes on potentially valuable Federal mineral lands in the eastern United States. A multilayered screening process begins with thresholding the change data and ends with field verification in order to screen out the brightness changes unrelated to mining on or near Federal minerals. A RIPS image processing microcomputer is used to display segments of each project area GIS and to develop the threshold statistics to be applied over each entire project area. Author

A86-21154#

EVALUATION OF THE CONTRIBUTION OF SATELLITE DATA TO GEOLOGICAL MAPPING

P. DUTARTRE, C. KING, and D. ROUSSELOT (Bureau de Recherches Geologiques et Minieres, Orleans, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 581-593. refs

The assistance contributed by preliminary use of SPOT data and Landsat MSS data to the medium-scale stages (1:25,000 to 1:100,000) of prospecting and systematic surveying was evaluated by comparison with ground radiometric data, a SPOT simulation acquired in winter conditions, and a 1:50,000 geological map prepared by standard mapping methods. The test areas were the Beauce (SPOT evaluation) and Valence (Landsat MSS evaluation) regions in France. The two basic assets of spatial remote sensing data are recognition of homogeneous areas with common spectral characteristics and the possibility of determining an overall structural system. Selective processing operations bring out the close correspondence between the spatial variation in ground surface reflectance and the distribution of the main surficial units. I.S.

A86-21193#

A STRATEGY FOR IMPLEMENTING REMOTE SENSING IN EXPLORATION GEOLOGY - APPLICATION TO THE ARMORICAN MASSIF (FRANCE)

J.-Y. SCANVIC (Bureau de Recherches Geologiques et Minieres, Orleans, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1113-1118. refs

A86-21194#

A REMOTE SENSING STUDY OF A SECTOR COLLAPSE VOLCANO (SOCOMPA, N CHILE)

D. A. ROTHERY and P. W. FRANCIS (Open University, Milton Keynes, England) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1119-1128. refs

A86-21213#

CHARACTERIZATION OF SPECTRAL SIGNATURES OF ALUMINOUS FORMATIONS (LATERITES AND BAUXITES) - POSSIBILITIES OF USING SATELLITE REMOTE SENSING FOR PROSPECTING FOR ALUMINOUS MINERALS

P. BILDGEN, J. BOULEGUE (Paris VI, Universite, Paris, France), and A. SIMONIN (CNRS, Centre d'Etudes et de Realisations Cartographiques Geographiques, Paris, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1383-1392. refs

The present paper is concerned with the problem of spectral characterization of aluminous lateritic rocks and bauxites, taking into account possibilities for the utilization of satellite data in prospecting for aluminous minerals. Previous studies are discussed, and the geological data of selected test-sites are considered. Attention is given to Haitian test-sites, test-sites in the southeast of France, and the conduction of laboratory and field studies. The analysis of spectrophotographic data and in situ field data shows clearly that in the spectral regions presently used by satellite sensors of the type employed by Landsat, only the occurrence of iron can be detected. A differentiation between aluminous kaolinic rocks and red sediments with a high content of aluminum hydroxides (bauxites) cannot be achieved on the basis of data obtained in this spectral region. However, the employment of new sensors, such as the Thematic Mapper, will improve possibilities for the differentiation. G.R.

A86-21237#

USE OF SATELLITE REMOTE SENSING FOR THE STRATEGIC AND TACTICAL PROSPECTION OF NON-OUTCROPPING GRANITIC APEXES - APPLICATION TO TIN-TUNGSTEN DEPOSITS [LA TELEDETECTION SPATIALE, UN MOYEN DE PROPSPECTION STRATEGIQUE ET TACTIQUE DES APEX GRANITIQUES NON AFFLEURANTS EXEMPLE D'APPLICATION AUX GISEMENTS ETAIN-TUNGSTENE]

B. MARCONNET and CL. CAGNY (Nancy I, Universite, Vandoeuvre-les-Nancy, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1645-1655. In French. refs

A86-21262#

APPLICATIONS OF DIGITAL IMAGE ENHANCEMENT IN REGIONAL TECTONIC MAPPING OF SOUTH INDIA

S. A. DRURY (Open University, Milton Keynes, England) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1895-1904. Research supported by the Open University. refs (Contract NSERC-GR/3/3685)

Regional tectonic modeling of complex Precambrian basement terrains is possible using a combination of mosaiced standard EDC photographic Landsat images, enhanced digital Landsat images and synergistic field traverses and mapping. The main provisos are the presence of residual soils, geological control over natural vegetation and careful selection of the dates of imagery. Tropical seasonal climates are favorable, as exemplified by the terrain of South India. Greatest structural information is provided by principal component analysis of Landsat MSS data and suitable edge enhancement. Such techniques are applied here to tectonic features of the Archaean and Proterozoic evolution of the South Indian craton. Author

A86-21263#

EXAMPLES OF AIRBORNE THERMAL INFRARED ANALYSIS APPLIED TO ENGINEERING GEOLOGY AND CIVIL WORKS SITE INVESTIGATIONS

C. M. MARINO, G. DEL PERO (Milano, Universita, Milan, Italy), and A. M. TONELLI (Luigi Rossi ARCO, Milan, Italy) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1905-1914. refs

Results obtained in some projects are demonstrated in order to assist geologists and engineers in determining and identifying particular surface phenomena detected in remotely sensed imagery. The phenomena are related, after ground truth investigations, to the presence of particular geologic or hydrogeologic events. Two examples of thermal infrared analysis are described: subsurface discontinuities detection (and related problems) and location of embankment leakage. D.H.

A86-21264#

REMOTE SENSING AND SUBSURFACE ANOMALIES IN THE BRESSE REGION OF FRANCE

F. BENARD, G. GESS, C. LALLEMAND, A. MARIE (Institut Francais du Petrole, Rueil-Malmaison, France), P. DUTARTRE (Bureau de Recherches Geologiques et Minieres, Orleans, France) et al. IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1915-1927. refs

An account is given of a study attempting to explain large scale lineaments and curvilinear phenomena seen on Landsat images of the Bresse region of France. The presence of the lineaments and phenomena cannot be explained by the surface geology (which consists mainly of cover deposits). A joint analysis of remote-sensing data and geophysical data (gravimetry) was conducted. Numerical techniques for creating composite images are discussed, along with the geological interpretations. A detailed analysis is given of an area where this method has revealed an impact of the morphology of the substratum on the overlying formations. D.H.

A86-21593

AIRBORNE GEOPHYSICS FOR GEOLOGICAL MAPPING AND REGIONAL EXPLORATION

C. V. REEVES (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) ITC Journal (ISSN 0303-2434), no. 3, 1985, p. 147-161. refs

Many countries already have or are planning to obtain complete national coverage of aeromagnetic surveys, often combined with airborne gamma-ray spectrometer and/or electromagnetic data. These surveys are usually designed to support and stimulate exploration by providing basic geophysical information to supplement existing geological maps. Large quantities of useful data are generated. Maximum benefit accrues where the geophysical data are: (1) freely published, (2) subjected to a thorough qualitative and quantitative interpretation, and (3) fully integrated with the existing geologic database for the country. The successful execution of (2) and (3) depends on obtaining a skillful balance between geophysical rigor and geological intuition. The process involves mechanical analysis of numerous anomalies, a somewhat subjective zoning of anomaly patterns, and an appropriate degree of respect for the available geologic information. Examples from several countries are used to demonstrate this, and some areas where new tools for the interpreter could improve his effectiveness are suggested as practical ITC research topics. Author

A86-21594
THE LUMINEX METHOD - A NEW GEOPHYSICAL METHOD FOR AIRBORNE AND GROUND PROSPECTING FOR ORE DEPOSITS

H. O. SEIGEL and J. C. ROBBINS (Scintrex, Ltd., Concord, Canada) ITC Journal (ISSN 0303-2434), no. 3, 1985, p. 162-166. Research supported by Rio Tinto Canadian Exploration, Ltd.

A new method for prospecting for minerals has been developed by a Canadian company based on the luminescence of minerals when exposed to an ultraviolet light source. Certain key minerals which are ore minerals themselves or frequently accompany other minerals can be detected from the air or with hand-held equipment on the ground. This extends the remotely detectable minerals to include tungsten, tin, molybdenum, gold and lead-zinc. The most important limitation of the method is that the minerals must be exposed, i.e., without soil or vegetation cover. Author

A86-21596
REPORT ON THE RESULTS IN GEOLOGY AND GEOMORPHOLOGY OF THE EUROPEAN SAR-580 EXPERIMENT

B. N. KOOPMANS (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) ITC Journal (ISSN 0303-2434), no. 3, 1985, p. 203-206. refs

Image data from a synthetic aperture radar (SAR) experiment are presented. The SAR operated n X/C and X/L band modes. The importance of the orientation of the slope facets with respect to radar look direction and depression angle in interpreting terrain morphology is analyzed. The tone, texture, pattern, and shape of the radar images are used to interpret the morphology and develop a geologic/geomorphologic model. The test sites and data processing of the images are described. It is concluded that the SAR data are useful for the study of drainage, geological structures, lineaments, and mineral occurrence; however, the data are not applicable to morphology and lithology. Areas of continued research are discussed. I.F.

A86-22555
THE TECTONICS OF SUBSALT DEPOSITS ACCORDING TO THE RESULTS OF A NUMERICAL ANALYSIS OF SPACE IMAGES OF THE WESTERN PART OF THE CASPIAN BASIN [TEKTONIKA PODSOLEVYKH OTLOZHENII PO REZUL'TATAM DESHIFRIROVANIIA KOSMICHESKIKH SNIMKOV ZAPADNOI CHASTI PRIKASPIISKOI VPADINY]

V. F. MOKIENKO (Volgogradskii Gosudarstvennyi Nauchno-Issledovatel'skii i Proektnyi Institut Neftianoi Promyshlennosti, Volgograd, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Sept.-Oct. 1985, p. 44-52. In Russian. refs

A86-22556
THE GEOLOGY OF THE BAYANUUL RING STRUCTURE (CENTRAL MONGOLIA) INFERRED FROM SPACE IMAGES [GEOLOGICHESKAIA PRIRODA BAIANUULSKOI KOL'TSEVOI STRUKTURY /TSENTRAL'NAIA MONGOLIIA/, VYIAVLENNOI PO KOSMICHESKIM SNIMKAM]

P. KHOSBAIAR and S. ARIUNBILEG (Academy of Sciences, Institute of Geology, Ulan Bator, Mongolian People's Republic) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Sept.-Oct. 1985, p. 53-57. In Russian. refs

A86-22832
EVALUATION OF SPOT SIMULATOR DATA FOR GEOLOGIC MAPPING IN THE SPLIT MOUNTAIN REGION, UINTAH COUNTY, UTAH

G. B. BAILEY (USGS, Sioux Falls, SD) and J. L. DWYER (Technicolor Government Services, Inc., Sioux Falls, SD) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 47-55.
(Contract USGS-14-08-0001-20129)

SPOT simulator data collected over the Split Mountain anticline were digitally enhanced and studied to evaluate their utility for geologic mapping. Band ratioing, principal components analysis, and color space transformation techniques were applied to the data, and resultant images were manually analyzed and interpreted to define the types and amount of geologic information provided. Enhanced SPOT simulator images and the corresponding geologic interpretations were evaluated in comparison with similarly enhanced and interpreted thematic mapper simulator imagery acquired over the same area. Results indicate that SPOT simulator data provide a marked improvement in the level of detail with which the sedimentary rock units in the study area can be mapped. Author

A86-22833
DIGITAL PROCESSING OF SPOT SIMULATOR AND LANDSAT TM DATA FOR THE SP MOUNTAIN REGION, ARIZONA

P. S. CHAVEZ, JR. and G. L. BERLIN (USGS, Flagstaff, AZ) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 56-66. refs

SPOT simulator images were digitally processed and compared with certain Landsat-4 Thematic Mapper (TM) images depicting the volcanic and sedimentary terrain of the SP Mountain region, Arizona. The image data sets were subjected to the following enhancement algorithms: edge enhancement, high-pass spatial filtering with n percent addback of the original-data, directional first differencing, and principal components (PC) analysis. Although statistical comparisons reveal that more radiometric or color information is present in certain triple TM band combinations than in the three SPOT bands, the SPOT-PC color-composite image proved to be useful for identifying many different surface materials. Because of SPOT's more favorable resolution, its images contain the highest level of terrain detail. Author

A86-22835
REVIEW OF SPOT IMAGERY SIMULATION AT THE COPPER CANYON CU-AU MINING AREA, LANDER COUNTY, NEVADA

R. A. METZ (Duval Corp., Tucson, AZ), D. W. BLAKE, and P. R. WOTRUBA (Duval Corp., Battle Mountain, NV) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 83-91. refs

The Copper Canyon Mining Area, about 16 km southwest of the town of Battle Mountain, Nevada, has a 120-year history of base and precious metal mining responsible for the production of over 180,000 short tons of copper, 1,000,000 oz. gold 7,000,000 oz. silver. Geology of the area consists mainly of complexly faulted Paleozoic sedimentary and volcanic rocks cut by Tertiary intrusives and locally overlain by Tertiary and Quaternary volcanics. Mineral deposits related to the Tertiary intrusives include porphyry copper-gold-silver and molybdenum systems, disseminated and skarn type gold-silver bodies, gold-silver and lead-zinc-silver veins. The SPOT Imagery simulation covers an area approximately 5 x 12 km over the Copper Canyon copper-gold deposit and extends to the Copper Basin disseminated molybdenite deposit, including a number of the vein systems mentioned above. In addition to mining-related cultural features, recognizable features on the imagery products discussed included various vegetation types, rock types, significant fault traces, and alteration haloes. Author

A86-22849
USE OF SIMULATED SPOT DATA FOR THE EVALUATION OF LANDSCAPE STABILITY IN A SEMI-ARID REGION

K. F. CONNORS, T. W. GARDNER, G. W. PETERSEN, J. R. EYTON, and G. M. BAUMER (Pennsylvania State University, University Park) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 220-228. refs
(Contract DE-AC02-83ER-60182)

Simulated SPOT data resolved complex landscape components near a deep uranium mine and milling operation in northwestern New Mexico. Landscape components and their stability must be determined to identify safe storage sites for uranium tailings.

Landscape stability is related to soil surface texture, vegetation cover, landscape position, and the interaction of these characteristics with surficial geomorphic processes. The CLUS program was used to cluster subsets of the simulated SPOT data to determine unsupervised feature signatures. Field investigations conducted in 1983 in conjunction with aerial photograph interpretation provided ground truth for signature identification. Using the CLASS program to classify a portion of the scene, it was possible to discriminate between stable, eolian-mantled uplands; metastable, intermediate surfaces with exposed B-horizons, salt pans and coppice dunes; unstable, fine-grained alluvial fills; and wet, well vegetated alluvial fills. The intensity-hue-saturation image displays these landscape components, clearly distinguishing between stable uplands, complex metastable intermediate surfaces, and unstable valley floors. Author

A86-24615

A MORPHO-STRUCTURAL ANALYSIS OF THE NORMANDY COPSE FROM THE SPACELAB-1 MISSION IRC PHOTOGRAPHS - WINTER PHOTOGRAPHS, STS-9 FLIGHT OF 2-12-1983 [INTERPRETATION MORPHO-STRUCTURALE DU BOCAGE NORMAND A PARTIR DE PHOTOS I.R.C. DE LA MISSION SPACELAB-1 - PHOTOGRAPHIES D'HIVER, VOL STS-9 DU 02.12.1983]

M. HELLUIN and J. PELLERIN (CNRS, Centre de Geomorphologie, Caen, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 99, 1985, p. 27-33. In French. refs

A86-25499

TRANSFORMATION OF GEOLOGICAL-GEOPHYSICAL AND HYPSOMETRIC MAPS WITH THE AIM OF IDENTIFYING PSEUDOCIRCULAR ANOMALIES (FORMS) FOR AUTOMATING THE INTERPRETATION OF RING STRUCTURES ON SPACE PHOTOGRAPHS [TRANSFORMIROVANIE GEOLOGO-GEOFIZICHESKIKH I GIPSOMETRICHESKIKH KART S TSEL'IU VYDELENIIA PSEVDOKRUGOVYKH ANOMALII (FORM) DLIA AVTOMATIZATSII PROTSESSA DESHIFRIROVANIIA KOL'TSEVYKH STRUKTUR NA KOSMICHESKIKH SNIMKAKH]

A. T. ZVEREV and A. I. STRYKOV (Moskovskii Institut Inzhenerov Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR) Geodeziia i Aerofotos'emka (ISSN 0536-101X), no. 5, 1985, p. 46-54. In Russian.

A86-26317* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

MULTIPOLARIZATION RADAR IMAGES FOR GEOLOGIC MAPPING AND VEGETATION DISCRIMINATION

D. L. EVANS, T. G. FARR, J. P. FORD, T. W. THOMPSON, and C. L. WERNER (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, March 1986, p. 246-257. NASA-supported research. refs

NASA has developed an airborne SAR that simultaneously yields image data in four linear polarizations in L-band with 10-m resolution over a swath of about 10 km. Signal data are recorded both optically and digitally and annotated in each of the channels to facilitate completely automated digital correlation. Comparison of the relative intensities of the different polarizations furnishes discriminatory mapping information. Local intensity variations in like-polarization images result from topographic effects, while strong cross polarization responses denote the effects of vegetation cover and, in some cases, possible scattering from the subsurface. In each of the areas studied, multiple polarization data led to the discrimination and mapping of unique surface unit features. O.C.

A86-27673

STRUCTURES OF CONTINENTAL AND TRANSITIONAL CRUST ON SPACE PHOTOGRAPHS [STRUKTURY KONTINENTAL'NOI I PEREKHODNOI ZEMNOI KORY NA KOSMICHESKIKH SNIMKAKH]

N. I. FILATOVA, I. V. EGOROV, A. I. DVORIANKIN, A. P. DOROGUTIN, and I. A. KUZNETSOVA Moscow, Izdatel'stvo Nedra, 1984, 212 p. In Russian. refs

The work demonstrates the possibility of using space remote-sensing images to obtain geological information about areas of the earth surface with different types of crustal structure. Photointerpretation techniques are described, and the relationship between ore deposits and crustal structures is examined. Particular consideration is given to the use of space images to study: the tectonics of the continent-ocean transition zone in the northeastern USSR; endogenic ring structures of the transitional zone; the continental crust of the pre-Riphean period, partly destroyed in the Paleozoic and Mesozoic; and the transitional crust formed in the late Mesozoic and Cenozoic. B.J.

N86-16702# New Mexico State Univ., Las Cruces. Energy Inst.

AN EVALUATION OF THERMAL REMOTE SENSING AS A LOW-COST REGIONAL GEOTHERMAL EXPLORATION TECHNIQUE IN NEW MEXICO Final Report

J. WHITTIER, M. INGLIS (New Mexico Univ., Albuquerque), and T. K. BUDGE (New Mexico Univ., Albuquerque) Mar. 1985 53 p

(DE85-901266; NMERDI-2-71-4221) Avail: NTIS HC A04/MF A01

Airborne and satellite borne thermal infrared scanner data were analyzed for application in the exploration of geothermal resources in New Mexico. The location for this study was the East Mesa Geothermal Field near Las Cruces, New Mexico. Primary sensor was the Thermal Infrared Multispectral Scanner (TIMS) which obtained data at 10-meter resolution. Additional data for comparison came from the Heat Capacity Mapping Mission (HCMM) satellite which provided data at 600-meter resolution. These data were compared to the soils, vegetation, and geology of the area, as well as borehole temperature data in an attempt to explain temperature patterns and anomalies. Thermal infrared scanner data were found to be too sensitive to solar-induced temperature anomalies to directly reflect the presence of subsurface geothermal anomalies but may provide valuable supporting information for a geothermal exploration program. DOE

N86-17935# Pacific Northwest Lab., Richland, Wash.

ADVANCED TECHNIQUES FOR LITHOLOGIC AND FRACTURE ANALYSIS UTILIZING THEMATIC MAPPER AND TOPOGRAPHIC DATA

H. P. FOOTE, R. L. THIESSEN, J. R. ELIASON, and G. E. WUKELIC Jun. 1985 12 p refs Presented at the NASA LIDQU Final Symposium: LANDSAT Image Data Quality Analysis Meeting, Indianapolis, Ind., 9 Sep. 1985 Prepared in cooperation with Washington State Univ., Pullman

(Contract DE-AC06-76RL-01830)

(DE85-018220; PNL-SA-13290; CONF-8509161-2) Avail: NTIS HC A02/MF A01

Under the LIDQA program, the Pacific Northwest Laboratory has been evaluating selected energy-related applications of the LANDSAT Thematic Mapper (TM) data from a user-agency perspective. This paper describes techniques that have been developed to correct for topographic-induced shading on TM surface reflectance and to perform topographic analysis to define crustal fracture zones as aids to geologic studies. These techniques require the use of only digital terrain and TM data. The analysis techniques have been successfully applied to the Paiute Ridge Quadrangle in Nevada, demonstrating the utility of the techniques for geologic studies. DOE

N86-18380# Centre National de la Recherche Scientifique, Valbonne (France). Centre de Recherches Archeologiques.
REMOTE SENSING AND ARCHAEOLOGICAL RESEARCH IN THESSALY, GREECE. NEW PROSPECTS IN ARCHAEOLOGICAL LANDSCAPE
E. BARISANO and B. HELLY *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 203-209 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

The use of satellite data in archaeological research in Thessaly (Greece) in a methodological study to determine the interpretation processes concerning spatial imagery is described. The study involved determining the physical factors in order to understand the ancient spatial organization in the lower Enipeus valley, connected with the distribution and density of identified sites with signs of human occupation. An archaeological prospection strategy was formulated from spectral, textural, and structural indicators deduced from satellite data in the eastern plain of Larisa (ancient lake Karla). Author (ESA)

N86-18382# Milan Univ. (Italy). Dept. of Earth Sciences.
LONG LINEAR FEATURES OBSERVED ON THE ALPINE OROGEN AND THEIR COMPARISON WITH SOME GEOPHYSICAL DATA
R. CASSINIS, C. M. MARINO, and F. PINALI *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 217-219 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

A map of linear features observed on the Alpine orogen was drawn on 1:1,000,000 scale, using multitemporal and multispectral satellite imagery (MSS LANDSAT). The total field, containing linears with L or = 15 km, was filtered in length and azimuth, obtaining different maps (6 azimuthal and 1 of long linears with l or = 50 km. The filtered maps were compared with geophysical data having a similar uniformity of information and drawn on the same scale. All maps were analyzed according to geological domains. It is believed that the long linears are the surface reflection of deep crustal structures. Author (ESA)

N86-18383# Catania Univ. (Italy). Dept. of Engineering.
MONITORING OF GROUND FRACTURES CAUSED BY VOLCANIC ERUPTIONS USING REMOTE SENSING TECHNIQUES
A. L. GERACI, G. LAROSA, T. CALTABIANO (CNR, Catania, Italy), and E. LOGIUDICE (CNR, Catania, Italy) *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 221-227 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

During the 1983 eruption of Mt Etna in Sicily, an investigation using remote sensing techniques was carried out over the southern side of the volcano to look at the linear development and the thermal behavior of ground fractures connected with active vents. The survey used thermal infrared imagery. It is proved that this kind of investigation makes it possible to locate thermal active fractures in the ground in active volcanic areas. It is possible to determine the length and direction of the fractures. It is also useful for the surveillance, study, and clearer representation of the eruption. Author (ESA)

N86-20238# Joint Publications Research Service, Arlington, Va.
GEOLOGICAL-GEOMORPHOLOGICAL INTERPRETATION OF PHOTO IMAGE PATTERNS IN SPACE PHOTOGRAPHS FOR WESTERN PART OF FERGANA VALLEY AND ITS MOUNTAINOUS FRAMEWORK Abstract Only
D. MAGZUMOVA *In its* USSR Report: Space (JPRS-USP-86-001) p 135 13 Jan. 1986 Transl. into ENGLISH from Uzbekskiy Geologicheskiy Zhurnal (Tashkent, USSR), no. 4, Jul. - Aug. 1985
Avail: NTIS HC A03

A detailed analysis of photo image patterns was carried out using multizonal photographs at 1:1,000,000 obtained from the LANDSAT satellite in four spectral ranges in the western part of the Fergana valley and the mountains surrounding it. With respect to geomorphological analysis of the patterns, the most informative photographs were obtained in the spectral zone 0.8-1.1 microns. The territory was represented by three major geomorphological types: mountainous uplifts, made up primarily of Plaeozoic deposits; adyr (desert plains without sands but with soft ground); and foothills consisting of Neogene and Lower- and Middle Quaternary deposits. On the basis of the photo image pattern it is possible to differentiate strongly, moderately and weakly dissected, undulating and flat surfaces. Flat and slightly undulating surfaces are interpreted on the basis of a geometrical or spotty pattern of cultivated landscapes; moderately dissected surfaces are discriminated on the basis of a jetlike pattern; well-dissected surfaces are discriminated from patterns form by adyr relief forms. Comparison of the interpreted photographs with Meteor photographs at 1:2,500,00 indicated that the latter reflect the nature of surface macrodissection. Their patterns are caused by relief megaforms associated with large geological structures. These photographs, at a larger scale, corresponded to the largest geomorphological regions. The photographs at 1,000,000, on the other hand, reflected lower-order structures. R.J.F.

N86-20241# Joint Publications Research Service, Arlington, Va.
GEOLOGICAL INFORMATION CONTENT OF MULTIZONAL PHOTOGRAPHS Abstract Only
N. A. YAKOVLEV and S. G. SLUTSKAYA *In its* USSR Report: Space (JPRS-USP-86-001) p 139 13 Jan. 1986 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1985 p 45-51
Avail: NTIS HC A03

An evaluation is given for the several methods now in use for evaluating the geological information content of space photographs. Multizonal photographs must be evaluated primarily on the basis of the effectiveness of reflection of spectral criteria. In this method in discriminating the feature and identifying it the problem will be solved more successfully the greater the contrast between the images of the discriminated feature and the background (adjacent features). Contrast can be used as the principal index of comparative information content of mutizonal images obtained in different survey channels. Definite procedures are given for determining contrast. It is concluded that there are no universally informative survey channels for discriminating the images of geological features on the basis of spectral criteria. The geological formation content of multizonal photographs as a whole and each survey channel separately can be evaluated only from the point of view of a specific problem. R.J.F.

N86-20242# Joint Publications Research Service, Arlington, Va.
GEOLOGICAL INFORMATION CONTENT OF SPACE PHOTOGRAPHS OBTAINED IN DIFFERENT SPECTRAL RANGES IN COURSE OF GOBI-KHANGAI EXPERIMENT (MUSHUGAY-GURVANBOGD TEST RANGE) Abstract Only
V. I. MAKAROV and G. I. VOLCHKOVA *In its* USSR Report: Space (JPRS-USP-86-001) p 140 13 Jan. 1986 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1985 p 52-58 Original language document was announced in IAA as A85-37118
Avail: NTIS HC A03

The Gobi-Khangai experiment was carried out from aboard the Salyut-6 Soyuz-39 orbital complex by a Soviet-Mongolian crew in April 1981. A multizonal space photographic survey of the Mushugay-Khuduk region was made. This area is situated in the north-central part of the Gobi, directly to the east of Gurvan-Bogd Range in the Gobi Altai. Included are the results obtained in an earlier (June 1973) survey of this same territory from the ERTS-1 satellite under different illumination conditions. The availability of data from two surveys made it possible to analyze photographic conditions more fully than would have been possible on the basis of the results of only one survey. The strengths and weaknesses of the two surveys are compared. The space photographs served as an excellent base for compiling a map of Quaternary deposits far exceeding the accuracy of maps compiled by surface methods.

These photographs made possible a considerable upgrading of earlier published geological and tectonic maps. The comparative analysis of the geological content of space photographs obtained in different spectral ranges indicated that for visual interpretation under conditions similar to the Gobi Altai it is sufficient to have images in the spectral range 0.8 to 0.9 microns the range 0.6 to 0.7 microns can be recommended as an additional range. A need for other ranges would arise only for obtaining synthesized images. Author

N86-20243# Joint Publications Research Service, Arlington, Va.
TECTONIC INTERPRETATION OF RESULTS OF INTERPRETATION OF SPACE PHOTOGRAPHS OF THE CAUCASUS Abstract Only
G. A. MIKHEYEV and M. G. MAKAROVA *In its* USSR Report: Space (JPRS-USP-86-001) p 141 13 Jan. 1986 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1985 p 59-66
Avail: NTIS HC A09

An extensive literature has already been devoted to the possibilities of space photographs of the Caucasus for the geological study of that region. These materials and published results of such work are reviewed and integrated. A full-page map shows the location of lineaments and structures of the central (annular) type in the Caucasus region; this map is used in describing the interpreted photographs. It is concluded that in the formation of the present-day tectonic plan a definite role is played by faults of sublatitudinal and northwesterly directions forming disjunctive systems, longitudinal tectonic sutures bounding the principal structural-formation zones of the region. Dislocations with breaks in continuity but belonging to a single system were formed at the same time and under the same geotectonic conditions. Their degree of expression on space photographs in the form of systems of lineaments is determined by the degree of their influence on the formation of present-day morphostructures, that is, by activity in the neotectonic and most recent stages in development of this region. Structures of the central type in most cases constitute a surface reflection of vertical movements of polygonal basement blocks. But there are some structures of the central type whose nature remains unclarified. Space photograph analysis has shown that these materials are of great practical and scientific value for seismic research. R.J.F.

N86-20244# Joint Publications Research Service, Arlington, Va.
PRINCIPAL PATTERNS OF MORPHOTECTONIC STRUCTURE OF EASTERN CAUCASUS DETECTED BY REMOTE SENSING METHOD Abstract Only
B. A. BUDAGOV, A. A. MIKAILOV, A. S. ALIYEV, and E. K. ALIZADE *In its* USSR Report: Space (JPRS-USP-86-001) p 142 13 Jan. 1986 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1985 p 67-72
Avail: NTIS HC A03

On space photographs, the Eastern Caucasus region in general is characterized by a quite nonuniform photoimage pattern attributable to sharp differences in the structure and strike of structural elements and a patchy composition of sedimentary strata. Against this background, interpretation of space photographs has made it possible to define major morphostructural zones, each having its own specific photoimage, pattern and phototone. Particular attention is devoted to the pattern of linear, arcuate and annular lineaments (a map of interpreted lineaments, accompanies the text). The overwhelming majority of lines fit into two conjugate systems of lineaments: orthogonal and diagonal. Lineaments of the orthogonal system with general Caucasian and anti-Caucasus directions show up on the space photographs more clearly and are characterized by a great extent. Longitudinal lineaments, constituting more than 60% of all the interpreted lines, are predominant. Lineaments of an anti-Caucasus strike are more difficult to interpret because they are less clearly expressed in the relief. The diagonal system includes lineaments of northeasterly and northwesterly strikes. The large lineaments for the most part coincide with faults detected by geological-geophysical methods. Many lineaments are not shown on existing tectonic maps and require field confirmation. Lineaments of each definite strike correspond to definte types of faults. The morphotectonic structure of the Eastern Caucasus as revealed by space photographs is entirely consistent with the theory of plate tectonics. R.J.F.

N86-20251# Joint Publications Research Service, Arlington, Va.
METHODS FOR STUDYING RECENT TECTONICS USING MATERIALS FROM REMOTE AND SURFACE DATA Abstract Only
A. A. FREYDLIN, Y. G. FARRAKHOV, and L. F. VOLCHEGURSKIY *In its* USSR Report: Space (JPRS-USP-86-001) p 147-148 13 Jan. 1986 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 1, Jan. - Feb. 1985 p 32-38 Original language document was announced in IAA as A85-29904
Avail: NTIS HC A03

Methods for the complex study of tectonic formations to the east of the near-Caspian depression have been developed on the basis of the interpretation of space (Salyut-4) and aerial photographs in conjunction with other types of geological and geophysical data. This approach led to the determination of: (1) the location and structure of recent tectonic zones; (2) the correlation of interpreted elements relief and deep teconic characteristics of the region; (3) the connection between oil deposits and tectonic and neotectonic activity; and (4) the role of tectonic processes in the formation of dispersed-sand massifs in the eastern Caspian region. B.J. (IAA)

N86-20252# Joint Publications Research Service, Arlington, Va.
POSSIBILITIES OF USE OF REMOTE METHODS FOR INCREASING EFFICIENCY OF PETROLEUM AND GAS EXPLORATION WORK Abstract Only
M. K. ISHANOV, V. A. YUSHIN, A. K. GAYAZOVA, and G. N. MALASHENKOV *In its* USSR Report: Space (JPRS-USP-86-001) p 148-149 13 Jan. 1986 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), n. 1, Jan. - Feb. 1985 p 39-46 Original language document was announced in IAA as A85-29905
Avail: NTIS HC A03

Space photoanomalies corresponding to structures promising for petroleum and gas are usually situated within the limits of anticlinal zones of petroleum and gas accumulation. Many buried anticlines in which petroleum and gas deposits have been discovered stand out as tonal photoanomalies in the near-IR spectral zone where the petroleum deposits show through as ovals of a darker tone, and gas deposits stand out in a lighter tone. Within the limits of the South Tajik Depression, for example, there are a number of discordant lineaments whose strike is not consistent with the most recent folding. Some of the most important features are sublatitudinal lineaments which can be identified with deep ancient faults which exert a great influence on the conditions for the formation and preservation petroleum and gas deposits. The combining of the results of traditional research methods and materials obtained by remote methods made it possible to define a number of promising regions which are recommended for further petroleum and gas exploration work. (These are clearly designated on the tectonic map). These promising regions are described in detail and some space photoanomalies within their limits are analyzed. R.J.F.

N86-20256# Joint Publications Research Service, Arlington, Va.
DISCRIMINATING HOMOGENEOUS REGIONS WITH INCOMPLETE BOUNDARIES ON IMAGE Abstract Only
A. A. ZLATOPOLSKIY *In its* USSR Report: Space (JPRS-USP-86-001) p 153-154 13 Jan. 1986 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 1, Jan. - Feb. 1985 p 94-102 Original language document was announced in IAA as A5-29912
Avail: NTIS HC A03

An image segmentation method according to identified parts of region boundaries is proposed in the framework of the interpretation of remote-sensing images. Results of a theoretical analysis of a structure generated by a distance transformation are presented, and an algorithm based on the structure is formulated. An example of the application of the algorithm to geological image analysis is examined. B.J. (IAA)

N86-20449# Joint Publications Research Service, Arlington, Va.
NEW METHOD FOR GEOLOGICAL INTERPRETATION OF ANNULAR STRUCTURES WITHIN COVERED AND PARTIALLY COVERED AREAS Abstract Only
B. S. ZEYLIK, L. G. PERFILYEV, A. N. VASILENKO, and E. Y. SEYTMURATOVA *In its* USSR Report: Space (JPRS-USP-86-002) p 66 10 Feb. 1986 Transl. into ENGLISH from Issledovaniye Zemli Iz Kosmosa (Moscow, USSR), no. 4, Jul. - Aug. 1985 p 31-40 Original language document was announced in IAA as A86-13279
Avail: NTIS HC A05

Digital modelling of topographic features in low angle sunlight is proposed to identify ring structures in remote sensing images. The technique was used to construct a relief image of the Shunak crater based on satellite measurements of solar irradiance in four directions. A map of the Shunak crater, showing the isolines of the total solar irradiance is provided. I.H.

N86-21004# Geological Survey, Denver, Colo.
INVESTIGATION OF AN AEROMAGNETIC ANOMALY ON WEST SIDE OF YUCCA MOUNTAIN, NEY COUNTY, NEVADA
G. D. BATH and C. E. JAHREN 1985 29 p refs
(Contract DE-AI08-78ET-44802)
(DE85-018329; USGS-OFR-85-459) Avail: NTIS HC A03/MF A01

Investigations of the source of a prominent aeromagnetic anomaly of 290 nT were undertaken at a potential repository site located in the Yucca Mountain area, Nevada Test Site. The anomaly was detected on a recent flight line of a survey flown north-south at 400 m (1300 ft) spacing and 122 m (400 ft) above the surface. The anomaly, which is on the high-standing side of a major fault, was interpreted previously as arising from either an increase of magnetization within a volcanic tuff or a small intrusive feature. Both air and ground anomalies were analyzed using geologic data from surface mapping and drill holes, and magnetic property data from drill holes. The anomaly is caused by contributions from at least three sources. The elevated topography gives a terrain effect since the altitude is decreased between the airplane and exposed Topopah Spring Member of the Paintbrush Tuff. Ground anomalies 300 m (1000 ft) south of the air maximum indicate either an increase in magnetization or the presence of a small intrusive body. Finally, there is an increase in magnetic influence from the nearby Solitario Canyon fault. DOE

N86-21970*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PERFORMANCE EVALUATION AND GEOLOGIC UTILITY OF LANDSAT-4 THEMATIC MAPPER DATA
E. D. PAYLOR, M. J. ABRAMS, J. E. CONEL, A. B. KAHLE, and H. R. LANG 15 Oct. 1985 77 p refs
(Contract NAS7-918)
(NASA-CR-176660; JPL-PUB-85-66; NAS 1.26:176660) Avail: NTIS HC A05/MF A01 CSCL 08B

The overall objective of the project was to evaluate LANDSAT-4 Thematic Mapper (TM) data in the context of geologic applications. This involved a quantitative assessment of the data quality including the spatial and spectral characteristics realized by the instrument. Three test sites were selected for the study: (1) Silver Bell, Arizona; (2) Death Valley, California; and (3) Wind River/Bighorn Basin area, Wyoming. Conclusions include: (1) Artificial and natural targets can be used to atmospherically calibrate TM data and investigate scanner radiometry, atmospheric parameters, and construction of atmospheric Modulation Transfer Functions (MTF's), (2) No significant radiometric degradation occurs in TM data as a result of SCROUNGE processing; however, the data exhibit narrow digital number (DN) distributioen suggesting that the configuration of the instrument is not optimal for each science applications, (30 Increased spatial resolution, 1:24,000 enlargement capability, and good geometric fidelity of TM data allow accurate photogeologic/geomorphic mapping, including relative age dating of alluvial fans, measurement of structural and bedding attitudes, and construction of such things as structural cross sections and stratigraphic columns. (4) TM bands 5 and 7 are particularly useful for geologic applications because they span a region of the spectrum not previously sampled by multispectral scanner data and are important for characterizing clay and carbonate materials. Author

N86-21971# Geological Survey, Flagstaff, Ariz.
DESERT STUDIES: A GLOBAL VIEW Final Report, 5 Apr. 1982 - 30 Jun. 1985
J. F. MCCAULEY, C. S. BREED, and M. J. GROLIER 23 Aug. 1985 24 p
(Contract MIPR-155-84)
(AD-A161453; ARO-18405.12-GS) Avail: NTIS HC A02/MF A01 CSCL 08F

Results of work on summary reports of the surficial geology and geomorphology of Coastal Peru, Western Desert of Egypt/Sudan, and deserts of China (including the Taklimakan, Badan Jarain, and Hohai Corridor) are outlined. Sections of summary reports on these hyperarid regions have been published as journal articles, interim technical reports, and abstracts. Significant new findings have been described in interim published reports on the Western Desert. These include the discovery of a buried paleofluvial terrain, over printed by aeolian erosion and deposition, which controls the topography and trafficability of much of southwest Egypt and northwest Sudan. A new model for the Western Desert relates a series of superposed river networks, concealed beneath a centimeters-to-meters thick veneer of wind blown sand sheets and dunes to the composition and distribution of surficial and subjacent geologic units, including soil parent materials. A key finding has been the role of groundwater carbonate deposition in recording the sequence of Quarternary fluvial episodes and climatic fluctuations in this region, as well as the present-day influence of the caliche deposits on radar responses of interfluve, valley fill, and inset channel units. Preliminary results of field reconnaissance, LANDSAT, and Shuttle Imaging Radar (SIR-A and SIR-B) studies of deserts in Northwest China show evidence there, too, of radar signal penetration through dry sand to underlying bedrock and alluvium. GRA

05

OCEANOGRAPHY AND MARINE RESOURCES

Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location.

A86-19481
REMOTE SENSING OF COASTAL AND OCEAN PROPERTIES
V. KLEMAS (Delaware, University, Newark) IN: Remote sensing; Proceedings of the Meeting, Arlington, VA, May 1, 2, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 42-54. refs

It is pointed out that remote sensing has become quite important for the monitoring of marine resources and for coastal research. The present paper has the objective to summarize the state of the art of the remote sensing of coastal and ocean properties and to indicate new sensing techniques needed for meeting user requirements. Coastal studies which can benefit from remote sensing are related to the mapping of coastal vegetation and its biomass, the monitoring of man-made and natural changes in the coastal zone, hydrographic charting, the mapping of geomorphic features, the detection of coastal fresh-water springs, the mapping of chlorophyll and nutrient-rich upwelling regions important to fisheries resources management, and the charting of current circulation. G.R.

05 OCEANOGRAPHY AND MARINE RESOURCES

A86-19506* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GODDARD LABORATORY FOR ATMOSPHERIC SCIENCES PHYSICAL RETRIEVAL SYSTEM FOR REMOTE DETERMINATION OF WEATHER AND CLIMATE PARAMETER FROM HIRS2 AND MSU OBSERVATIONS

J. SUSSKIND (NASA Goddard Space Flight Center, Greenbelt, MD) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 122-128. refs

At the Goddard Laboratory for Atmospheric Sciences (GLAS) a physically based satellite temperature sounding retrieval system, involving the simultaneous analysis of HIRS2 and MSU sounding data, was developed for determining atmospheric and surface conditions which are consistent with the observed radiances. In addition to determining accurate atmospheric temperature profiles even in the presence of cloud contamination, the system provides global estimates of day and night sea or land surface temperatures, snow and ice cover, and parameters related to cloud cover. Details of the system are described elsewhere. A brief overview of the system is presented, as well as recent improvements and previously unpublished results, relating to the sea-surface intercomparison workshop, the diurnal variation of ground temperatures, and forecast impact tests. Author

A86-19508

REQUIREMENTS FOR SPACE-SENSED OCEANOGRAPHIC DATA

D. C. HONHART (U.S. Navy, Washington, DC) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 142-148.

Requirements and the desirability of the Navy Remote Ocean Sensing System (NROSS) from the Navy's viewpoint are examined. The benefits that were shown by the short-lived Seasat satellite would be greatly exceeded by the proposed NROSS. The proposal is to fly the NROSS oceanographic satellite as part of the Defense Meteorological Satellite Program constellation. The Navy's intention is to make the processed ocean data available to the civil and scientific communities through existing NOAA communications circuits. To provide equivalent needed coverage of the ocean environment by conventional means (ships, buoy, etc.), would be twice as costly as the proposed 290 million dollar NROSS oceanographic satellite in the first three years of operation. D.H.

A86-19509

CIVIL OCEANIC REMOTE SENSING NEEDS

J. W. SHERMAN, III (NOAA, Oceanic Sciences Branch, Washington, DC) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 149-158. refs

The analysis of the requirements for satellite-derived oceanic data to meet the needs of the civil marine community has been a continuing effort by the National Oceanic and Atmospheric Administration (NOAA). The priorities established for the most critical data are, in decreasing order: winds, sea surface temperature, waves, sea ice, ocean color, and circulation and currents. The general needs of academic, commercial, and governmental users are considered, with more detailed requirements for wave data presented as an example. The consideration of these needs are presented within the context of planned satellites that have been designed to meet national and international scientific and operational requirements. Author

A86-19510* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SPACEBORNE STUDIES OF OCEAN CIRCULATION

W. C. PATZERT (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 159-164. NASA-supported research.

The history and near-term future of ocean remote sensing to study ocean circulation are examined. Seasat provided the first-ever global data sets of sea surface topography (altimeter) and marine winds (scatterometer) and laid the foundation for the next generation of satellite missions planned for the late 1980s. The future missions are the next generation of altimeter and scatterometer to be flown aboard TOPEX (TOPography EXperiment) and NROSS (Navy Remote Sensing System), respectively. The data from these satellites will be coordinated with measurements made at sea to determine the driving forces of ocean circulation and to study the oceans' role in climate variability. The significance of such studies to such matters as climatic changes, fisheries, commerce, waste disposal, and national defense is noted. D.H.

A86-19511* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

OBSERVING THE POLAR REGIONS FROM SPACE

R. H. THOMAS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 165-171. NASA-supported research. refs

The use of active and passive microwave sensors to provide information on the ice cover in the earth's polar regions is described, along with the ice characteristics that can be measured by such techniques. The continental ice sheets of Greenland and Antarctica represent vast reservoirs of fresh water that can significantly impact sea level if the ice sheets are changing in size. Satellite remote sensing gives information on: sea ice extent and physical characteristics; detailed images of ice flows and open-water leads within the ice pack; sea-ice movement; zones of summer melting and snow-accumulation rates on the continental ice sheets; accurate estimates of ice-surface elevation and detection of zones on the ice sheet that are either thickening or thinning; accurate, all-weather mapping of ice coastlines and large crevasses, and estimates of ice discharge rates from the ice sheets. D.H.

A86-19512

ALTIMETER FOR THE OCEAN TOPOGRAPHY EXPERIMENT (TOPEX)

J. L. MACARTHUR and P. V. K. BROWN (Johns Hopkins University, Laurel, MD) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 172-180. refs

The evolution of satellite altimetry from Skylab-1, GEOS-3, and Seasat-1 to the current U.S. Navy Program, Geosat-A, has been accompanied by a continuing improvement in measurement precision along with a better understanding of those factors internal and external to the instrument that act to limit precision. The precision goal of 2 centimeters imposed by the TOPEX mission will be realized by incremental enhancements to existing designs whose effectiveness has been demonstrated. The TOPEX altimeter will use a high pulse-rate, burst waveform and dual frequency (13.6/5.3 GHz) operation to minimize height measurement noise and remove ionospheric bias. Author

A86-19514* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

NROSS SCATTEROMETER - AN INSTRUMENT FOR GLOBAL OCEANIC WIND OBSERVATIONS

F. LI, C. WINN, D. LONG, and C. GEUY (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 193-198. NASA-supported research. refs

One of the instruments - the NROSS scatterometer or SCATT - to be launched on the Navy Remote Ocean Sensing System spacecraft in 1989 is discussed. To determine wind speed and direction that SCATT will measure the ocean normalized radar cross section (NRCS) by illuminating the ocean's surface with microwave pulses and measuring the return signal power. A wind retrieval algorithm is used to compute the wind speed and direction from the measured NRCS. Winds over at least 90 percent of the global, ice-free ocean will be observed at least once every two days. For NASA users, the system will retrieve winds with an accuracy of plus or minus 2 m/s or 10 percent whichever is greater, for wind speeds ranging from 3 to 30 m/s. D.H.

A86-19515

LOW FREQUENCY MICROWAVE RADIOMETER FOR N-ROSS

J. P. HOLLINGER and R. C. LO (U.S. Navy, Naval Research Laboratory, Washington, DC) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - the International Society for Optical Engineering, 1984, p. 199-207. Previously announced in STAR as N85-23819. refs

The all weather, global determination of sea surface temperature (SST) has been identified as a requirement needed to support naval operations.The target SST accuracy is + or 1.0 K with a surface resolution of 10 km. Investigations of the phenomenology and technology of remote passive microwave sensing of the ocean environment over the past decade have demonstrated that this objective is presently attainable. Preliminary specification and trade off studies were conducted to define the frequency, polarization, scan geometry, antenna size, and other essential parameters of the low frequency microwave radiometer (LFMR). It will be a meter deployable mesh surface antenna. It is to be flown on the Navy-Remote Ocean Sensing System (N-ROSS) satellite scheduled to be launched in late 1988. M.G.

A86-19516

PRACTICAL APPLICATIONS OF NIMBUS-7 COASTAL ZONE COLOR SCANNER DATA

W. A. HOVIS (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 208-211.

An account is given of how the Coastal Zone Color Scanner (CZCS), launched on the Nimbus-7 spacecraft in October of 1978, is being used as a quasi-operational instrument even though it was designed strictly for research and had only a one-year expected lifetime. It has been used to guide scientific vessels to areas of particular interest and to guide fisherman to areas of optimum probability for catching fish. On-orbit recalibration of the instrument has been accomplished to compensate for long-term degradation. The lessons learned provide valuable insight into how a future operational CZCS should be built. D.H.

A86-19517

FUTURE SYSTEMS FOR SPACEBORNE OCEANOGRAPHY

C. T. SWIFT, R. E. MCINTOSH, R. S. RAGHAVAN, C. A. WILEY, and L. E. SOMERS (Massachusetts, University, Amherst) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 212-220. refs

As a proof of concept, the Seasat oceanographic satellite successfully demonstrated the role of microwave sensors to synoptically measure geophysical parameters of interest to the oceanographic and meteorological communities. Nevertheless, problems surfaced, which can be corrected by improved system design concepts. Indeed, the next generation of satellite systems will incorporate modest engineering improvement which will greatly ease data reduction problems. Of more importance, however, the Seasat activity has generated ideas for new classes of measurements for the future. This paper explores a possible long term system growth in microwave scatterometry and radiometry. Author

A86-20101

REMOTE SENSING FOR OCEANOGRAPHY - AN OVERVIEW

L. F. MCGOLDRICK (Johns Hopkins University, Lawrence, MD) Johns Hopkins APL Technical Digest (ISSN 0270-5214), vol. 6, Oct.-Dec. 1985, p. 284-292. refs

A development history of satellite-based oceanographic studies is presented, with a view to technological trends and prospective developments for the remaining years of this century. Attention is given to the progressively deeper investigation of wind stresses driving oceanic currents by means of Ku-band radars, pencil beam radiometer/scatterometer, and SAR, as well as of mesoscale variability, and the contributions of radar altimetry to sea level studies and of data collection and location systems to the Global Weather Experiment. Global marine wind, sea surface topography, and phytoplanktonic and temperature patterns' correlation study results are used to illustrate noteworthy successes for satellite-borne oceanography. O.C.

A86-20106

HYDRODYNAMICS AND RADAR SIGNATURES OF INTERNAL SOLITONS IN THE ANDAMAN SEA

J. R. APEL, D. R. THOMPSON, D. G. TILLEY (Johns Hopkins University, Laurel, MD), and P. VAN DYKE (T. Rowe Price Associates, Baltimore, MD) Johns Hopkins APL Technical Digest (ISSN 0270-5214), vol. 6, Oct.-Dec. 1985, p. 330-337. refs

Attention is given to the hydrodynamic properties of the internal soliton wave phenomena reported to occur with exceptional frequency in the Andaman Sea region of the Indian Ocean, in light of Shuttle Imaging Radar data. The current theory for internal solitary waves and radar backscatter modulations from them yields reasonable estimates for both the hydrodynamics and electromagnetics of the phenomena, at least for the case of low wind speeds and 30-cm radar wavelength. The cnoidal wave packet model, when used in conjunction with the imagery in question and historical density profiles, yields wave property values that are well within + or - 50 percent of the actual ones. O.C.

A86-20109

MEASUREMENTS OF DIRECTIONAL WAVE SPECTRA BY THE SHUTTLE SYNTHETIC APERTURE RADAR

F. M. MONALDO (Johns Hopkins University, Laurel, MD) Johns Hopkins APL Technical Digest (ISSN 0270-5214), vol. 6, Oct.-Dec. 1985, p. 354-360. refs

Directional ocean wave spectra were made in high sea states near Tierra del Fuego during October 1984, using the Shuttle Imaging Radar-B (SIR-B) SAR instrument; independent simultaneous measurements of ocean wave spectra were made by a complement of airborne instruments. A comparison of the SIR-B experiment results with the radar ocean wave spectrometer data obtained suggests that the SAR image intensity variance spectrum for range-traveling waves is most closely associated with the ocean slope variance spectrum. The azimuth resolution limitations induced by ocean surface motion, which are inherent in Seasat imagery, are substantially reduced by a low altitude SAR. O.C.

A86-20671* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

THE NASA/JPL PILOT OCEAN DATA SYSTEM CATALOG

J. A. JOHNSON (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 148-152. NASA-supported research.

Data from various ground and satellite sensors collected and processed by various institutions cannot be used easily without a well planned method of determining their existence and location. The Global On-Line Data (GOLD) Catalog will provide a requestor with the ability to determine the existence of specific data holdings by specifying any combination of platform, measurement, location, or time. By this means, one can obtain details of data held at PODS and also at cooperating remote archives. Author

A86-21112#

THE APPLICATION AND POTENTIAL OF REMOTE SENSING TO PLANNING AND MANAGING THE GREAT BARRIER REEF OF AUSTRALIA

D. L. B. JUPP, K. K. MAYO (CSIRO, Div. of Water and Land Resources, Canberra, Australia), D. A. KUCHLER (North Queensland, University, Townsville, Australia), D. VAN R. CLAASEN, R. A. KENCHINGTON (Great Barrier Reef Marine Park Authority, Townsville, Australia) et al. IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 121-137. refs

The CSIRO Division of Water and Land Resources has cooperated with the Great Barrier Reef Marine Park Authority (GBRMPA) and the Australian Survey Office (ASO) to establish comprehensive remote sensing based reef mapping procedures. The research established the benefits of remotely sensed data to planning and managing the GBR Marine Park as well as methods of analysis specific to the problems of reef top mapping. The ASO is applying a mapping program based on this research to the whole of the GBR and will complete the task (involving some 24 Landsat scenes) by December 1984. The products consist of rectified Landsat imagery at 1:250,000 and 1:100,000 scales and standard thematic products which indicate approximate bathymetry, reef geomorphological and cover zones and reef environmental parameters such as exposure to weather. Author

A86-21114#

GEOSAT AND N-ROSS

J. W. SHERMAN, III (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 159-166.

The United States through the efforts of the Department of Defense will launch two satellites of significance to all marine users. In February, 1985, Geosat is to be launched to conclude the geodetic mission begun by Seasat. In mid-1989 a major thrust forward in applying satellite-derived oceanic data to operational marine needs will be made by the Navy Remote Ocean Sensing System. This paper emphasizes the technical characteristics of these two satellites and the expected oceanic products, with the focus on winds and waves and their all-weather monitoring capabilities. Author

A86-21116*# National Aeronautics and Space Administration, Washington, D.C.

TOPEX/POSEIDON - A PROPOSED JOINT NASA/CNES ALTIMETRY MISSION

W. S. WILSON (NASA, Washington, DC) and J.-L. FELLOUS (CNES, Paris, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 187-190. refs

A dedicated altimetry mission has been proposed to be conducted jointly by the U.S. National Aeronautics and Space Administration (NASA) and the French Centre National d'Etudes Spatiales (CNES). The mission goal would be focused on advancing the understanding of the general circulation of the global oceans. The mission would involve a U.S. satellite carrying U.S. and French sensors and launched by a French Ariane launch vehicle. Launch would occur in 1990, and the mission would be planned as an integral part of oceanographic programs being proposed under the auspices of the World Climate Research Program. Author

A86-21149#

REMOTE SENSING THE NEARSHORE VEGETATION OF QUEBEC COASTS

E. LAMBERT, A. LAVOIE, J.-M. M. DUBOIS, D. CLAVET (Sherbrooke, Universite, Canada), L. GENDRON (Quebec, Ministere de l'Agriculture, des Pecheries et de l'Alimentation, Gaspe, Canada) et al. IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 535-541. Research supported by the Ministere de l'Agriculture, des Pecheries et de l'Alimentation du Quebec. refs

Remote sensing of nearshore vegetation in a marine environment is limited by light penetration and water depth. This constraint is more or less present depending on the water quality and the water depth at which the vegetation stands. A method was developed for sensing submerged vegetation by using airborne images for digital analysis. Results from the digital data analysis are highly similar to the ground truthed data. Therefore the digital analysis of airborne images offers an accurate technique for remote sensing submerged vegetation. Author

A86-21157#

COMPARISON BETWEEN THERMAL AND VISIBLE SATELLITE IMAGERY TO ASSESS COASTAL UPWELLINGS IN THE MEDITERRANEAN

D. CARAUX, C. MILLOT (Laboratoire Arago, Banyuls, France), and G. JACQUES (Museum National d'Histoire Naturelle, La Seyne-sur-Mer, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 621-628. CNRS-Navy-supported research. refs

A comparative study of satellite imagery delineating thermal boundaries or bio-optical fronts in the Gulf of Lions is reported. Infrared and visible data were compared after image processing analysis. These sensors are borne by satellite placed on sun-synchronized orbits. Their orbit characteristics allow an almost simultaneous visualization of oceanic features (sea surface temperature, suspended matter in the first layers of the ocean). Before deriving these parameters from satellite data, raw data were calibrated and atmospheric correction was implemented. In order to compare data from various sensors aboard various satellites, distorted images were corrected for geometry. A set of visible and infrared satellite images was processed and compared so as to specify the biological environment associated with coastal upwellings in the Mediterranean. The purpose of the present study was to establish correlations between the observed surge of suspended matter (visible signal) and upwelling of colder deep water (infrared signal). The study points out the complementary usefulness of sensing simultaneously the different bands of the light spectrum to obtain physical and biological information regarding coastal dynamics. Author

A86-21158#

EVALUATION OF LANDSAT THEMATIC MAPPER DATA FOR SHALLOW WATER BATHYMETRY

F. J. TANIS (Environmental Research Institute of Michigan, Ann Arbor) and W. A. HALLADA (Science Applications Research, Riverdale, MD) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 629-643. DMA-supported research. refs
(Contract N00014-83-C-2234)

In response to the increased demand for updated accurate charts of the world's oceans, the Defense Mapping Agency (DMA) and other global hydrographic survey and charting organizations have begun the development of a remote bathymetry capability. Essentially the possibility of an implementation of the considered passive remote sensing technique depends upon finding a relationship between the measured water depth and the reflected radiance in one or more wavelength bands. The remote bathymetry effort had the objective to develop a satellite and airborne capability involving either lidar or an active/passive scanner system. The latter is preferred for airborne applications because of the greater spatial sampling. The feasibility of a use of the Landsat 4 imaging instruments MSS and TM was investigated. In the present paper, the quality and information content of TM are compared with MSS. The capabilities of simple regression type algorithms to extract water depth information are also explored. G.R.

A86-21166#

ATMOSPHERIC EFFECTS IN MULTIPLE-LOOK OBSERVATIONS FROM SPACE

G. KHOSRAVIANI and A. P. CRACKNELL (Dundee, University, Scotland) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 751-757. refs

In this paper attention is given to the results of some calculations based on the use of Coastal Zone Color Scanner (CZCS) data for the Irish Sea viewed from two successive orbits of the Nimbus-7 satellite. The atmospheric components have been extracted from successive orbits and compared. There are two motives for this. First, this provides a novel method of evaluating results obtained from CZCS data which have, traditionally, only been evaluated by attempting to make in-situ measurements of chlorophyll concentration. Secondly, the approaching launch of the first of the SPOT series of satellites opens up the possibility of obtaining stereoscopic images from space and it is believed to be important to try to evaluate the significance of atmospheric effects on the quality of such images. Author

A86-21178*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RADIOMETRIC COMPARISON OF TWO OCEAN COLOR SCANNERS NIMBUS-7/CZCS AND OSTA-1/OCE

H. H. KIM (NASA, Goddard Space Flight Center, Greenbelt, MD; DFVLR, Institut fuer Optoelektronik, Oberpfaffenhofen, West Germany), H. VAN DER PIEPEN, M. VIOLLIER, R. FIEDLER, J. S. VAN DER PIEPEN (DFVLR, Institut fuer Optoelektronik, Oberpfaffenhofen, West Germany) et al. IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 931-937. refs

On November 14, 1981 the area around the Gibraltar Strait was observed by two different ocean color scanners: a Space Shuttle-borne Ocean Color Experiment and Coastal Zone Color Scanner (Nimbus-7/CZCS). This presented an opportunity to study the gradual degradation of the CZCS sensitivity by comparing the two sensors. Upwelling radiances from eleven targets were compared. The results of the analysis indicate that the CZCS sensitivities at channels 1 and 2 are down to 65 percent and 78 percent. However, the evidence for channels 3 and 4 deterioration could not be found. Author

A86-21196#

THE IDENTIFICATION OF THE SURFACE EXPRESSIONS OF BATHYMETRIC FEATURES FROM SAR OCEAN IMAGES

R. L. G. SCHUMANN, M. A. FIDDY (King's College, London, England), and L. W. THORPE (Scicon, Ltd., London, England) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1153-1160. SERC-supported research.

It is well known that microwave images obtained by side-looking SAR imagers such as Seasat reveal much structure in the oceans. The problems associated with making a quantitative assessment of the relation between images taken over the ocean by Seasat and images derived from known bathymetric information taken from Admiralty charts are described. While it is often fairly straightforward to judge by eye the correlation between map depth contours and the corresponding SAR image, considerable preprocessing of the available data is required in order to most effectively determine the degree of correlation. Examples are given and the relevance of this work to the Shuttle Imaging experiment (SIR-B) is discussed. Author

A86-21197#

THEMATIC STUDY OF 1982 SPOT SIMULATION OF ROSCOFF AND THE WEST COAST OF THE COTENTIN PENINSULA (FRANCE)

T. BELSHER (Centre National pour l'Exploitation des Oceans, Roscoff, France) and M. VIOLLIER (CNRS, Roscoff, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1161-1166.

Partial analysis of SPOT simulated imagery for the remote sensing of intertidal seaweeds are presented. Attempts are made to give quantitative evaluation of the vegetation cover percentage and to appreciate the reliability of the species differentiation obtained from statistical analysis. Author

A86-21210#

A METHOD TO INTEGRATE NOAA/AVHRR INFRARED IMAGE WITH CHLOROPHYLL CONCENTRATION MAP GENERATED BY CZCS DATA AND ITS APPLICATION TO THE SEA OF OKHOTSK

M. SATO, Y. TOZAWA, M. IOKA (IBM Japan, Ltd., Japan Science Institute, Tokyo), K. MUNEYAMA, Y. SASAKI (Japan Marine Science and Technology Center, Yokosuka) et al. IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1343-1352. refs

A method to superimpose a sea-surface temperature map on a chlorophyll concentration map is presented. These maps are provided through the observation by NOAA and Nimbus-7 satellites. A sea-surface temperature map is first transformed into an isothermal lines map after the lands and the areas covered with ice and clouds are detected and labelled. This isothermal lines map is then superimposed on a chlorophyll concentration map. With the CZCS data, geometric correction, which is usually a process required to superimpose the images, is carried out without using the anchor point data. This is advantageous to users because the anchor point data are often missing in the data records. Orbital information is estimated by considering such information as satellite motion and two ground control points. This information is necessary when geometric distortion is corrected into a Mercator projection. As an example, a scene of the Sea of Okhotsk is processed and the results are discussed. Author

A86-21219#

STUDY OF MARINE AND INTERTIDAL ZONES OF THE BAY OF MONT SAINT MICHEL ON THE BASIS OF SPOT SIMULATION [ETUDE DES ZONES MARINE ET 'INTERTIDALE DE LA BAIE DU MONT SAINT MICHEL A PARTIR D'UNE SIMULATION SPOT]

R. M. ZBINDEN (Ecole Normale Superieure, Montrouge, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1443-1451. In French. refs

Daedalus radiometer data on the Bay of Mont Saint Michel acquired on September 17, 1982 were used for SPOT simulations. An interpretation of the marine zone and of the strand on the basis of the simulations is proposed. Simulation data are validated using sea measurements of turbidity and strand measurements of sediment reflectance. B.J.

A86-21234#

UNITED STATES COAST GUARD ACQUISITION OF REMOTE SENSING CAPABILITY FOR OCEAN SURVEILLANCE

J. R. WHITE (USCG, Washington, DC) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1605-1615.

An account is given of the U.S. Coast Guard development of an airborne, real-time, all-weather, day/night remote sensing system that will detect oil slicks at sea and identify violating vessels. The system has been designated 'Aireye' and will be installed on six of the 41 new Falcon 20 G jet aircraft (military designation HU-25A) which the Coast Guard has recently purchased as its medium range surveillance aircraft. The sensor system will include a side-looking airborne radar, three channel IR/UV line scanner, aerial reconnaissance camera, airborne data annotation system, and a control-display-record console. An active gated television camera will be used to identify vessels at night. D.H.

A86-21235#

APPLICATION OF A FORWARD LOOKING THERMAL SCANNER FOR DETECTING AND MONITORING OIL SPILLS

H. T. RIPLEY (Atlantic Canada Airborne Sensing Inc., Amherst) and R. H. GOODMAN (Esso Resources Canada, Ltd., Calgary) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1617-1627. Research supported by the Canadian Offshore Aerial Applications Task Force. refs

An oil spill dispersant sea trial was held offshore Halifax, Nova Scotia, Canada (44 deg 30 m N, 63 deg 00 m W) during the period September 12-17, 1983. Remote sensing played an integral part of the experiment. A specialized aircraft, instrumented for remote sensing research was used for airborne data collection. Part of the sensor package included a forward looking thermal infrared scanner. This was the first time this type of scanner was mounted on a fixed wing aircraft in Canada and the first test of its ability to detect and monitor marine oil spills. The program, including the thermal scanner operation, was quite successful. The data collected during the trials was instrumental in the determination of the overall experiment effectiveness. Author

A86-21239#

VISIBLE AND INFRARED SEA ICE MAPPING FROM SATELLITES

B. WANNAMAKER, A. CONDAL, and H. LE (Department of the Environment, Atmospheric Environment Service, Downsview, Canada) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1671-1675. refs

The type and extent of ice covering the world's ocean has important economic and climatic effects. High latitude resource development, biological productivity and air-sea interaction are all inhibited by ice. Satellite visible and infrared data have aided sea ice monitoring for twenty years but improving knowledge of the parameters of ice is changing the way the data is used. Considering data from the Advanced Very High Resolution Radiometer, an 'ice channel' is created from a combination of the visible and near infrared data. The 12 micron channel or a 'sea surface temperature' channel is generally better at detecting ice than the 10.5 micron channel. The artificial channels are used in an example of multispectral classification of ice in the Gulf of St. Lawrence. Author

A86-21243#

MOTIONS AND CONCENTRATIONS OF SUSPENDED MATTER IN THE SURFACE WATERS OF THE ENGLISH CHANNEL [MOUVEMENTS ET CHARGES EN MATIERES EN SUSPENSION DES EAUX DE SURFACE DE LA MANCHE]

Y.-F. THOMAS (Ecole Normale Superieure, Monrouge, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, *Environmental* Research Institute of Michigan, 1985, p. 1703-1713. In French. refs

Suspended matter in the surface waters of the English Channel was studied using Nimbus-7 Coastal Zone Color Scanner imagery. The imagery led to the identification of an eddy of about 3000 sq km that was predicted by numerical models. The large volume and high quality of the data (16 scenes for 1981) made it possible to determine the concentration of suspended matter over the annual cycle at each point of the Channel and to calculate a function describing the variation of this concentration. Large temporal variations of the concentration of suspended matter were observed under the combined effect of river discharges, tidal currents, and swell. B.J.

A86-21245#

DISPLAYING CZCS DATA IN 'TRUE COLOUR' MODE

M. VIOLLIER (CNRS, Station Biologique, Roscoff, France) and G. BELBEOCH (Centre National pour l'Exploitation des Oceans, Brest, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1727-1730. refs

On the Coastal Zone Color Scanner (CZCS) imagery, atmospheric effects usually mask the sea surface. To obtain useful information, atmospheric corrections are required. However, the current algorithms consume important computer-time. Furthermore, in some cases, results may be questionable due to uncertainties on the aerosol type and on the degradation of the radiometric calibration of the scanner. To test the reliability of the operations, a simple and practical way to discern some ocean-related features from atmospheric effects, consists in using a color composite of three channels (443, 520 and 670 nm). Author

A86-21266#

OBSERVATION AND STUDY OF ICE EDGE EDDY DYNAMICS IN THE EAST GREENLAND CURRENT AS SEEN FROM SATELLITE

A. M. COWAN, S. POLAR (Cambridge University, England), and K. A. ULBRICHT (DFVLR, Institut fuer Optoelektronik, Wessling, West Germany) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1945-1954. refs

The ice cover of the East Greenland Current (EGC) represents the classic case of a marginal ice zone (MIZ). A mesoscale (smaller than 100 km) vortex has been closely studied, which appears to be spatially stationary. It is located in the Strait between Iceland and Greenland. An analysis of NOAA 6, 7, and 8, as well as Landsat satellite imagery shows the morphological and dynamical variation of the feature. Author

A86-21269#

CONSTRUCTION OF A HYPSOMETRIC MODEL BY A DIACHRONIC ANALYSIS OF THREE SPOT SIMULATIONS [CONSTITUTION D'UN MODELE HYPSOMETRIQUE PAR ANALYSE DIACHRONIQUE DE TROIS SIMULATIONS-SPOT]

F. CUQ (Ecole Normale Superieure, Montrouge, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1955-1960. In French.

The paper presents a method for constructing a hypsometric model of a tide-balancing zone on the basis of a collection of high-spatial-resolution satellite images acquired at different moments of the tide. The modeling methodology is discussed in detail, and results are presented for three simulated SPOT images. B.J.

A86-21301* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

METHODS OF SATELLITE OCEANOGRAPHY

R. H. STEWART (California Institute of Technology, Jet Propulsion Laboratory, Pasadena; California, University, Scripps Institution of Oceanography, San Diego) Research supported by Navy, University of California, and NASA. Berkeley, CA, University of California Press, 1985, 369 p. refs

The theoretical basis for remote sensing measurements of climate and ocean dynamics is examined. Consideration is given to: the absorption of electromagnetic radiation in the atmosphere; scattering in the atmosphere; and satellite observations using visible light. Consideration is also given to: the theory of radio scatter from the sea; scatter of centimeter waves from the sea; and the theory of operation of synthetic aperture radars. Additional topics include: the coordinate systems of satellite orbits for oceanographic remote sensing applications; the operating features of the major U.S. satellite systems for viewing the ocean; and satellite altimetry. I.H.

A86-22551

TRANSVERSE JETS IN COASTAL UPWELLINGS - SPACE-BASED DATA AND SOME PHYSICAL HYPOTHESES [SISTEMY POPERECHNYKH STRUI V PRIBREZHNYKH OPVELLINGAKH SPUTNIKOVAIA INFORMATSIIA I FIZICHESKIE GIPOTEZY]

A. I. GINZBURG and K. N. FEDOROV (AN SSSR, Institut Okeanologii, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Sept.-Oct. 1985, p. 3-10. In Russian. refs

The physical characteristics of near-surface water jets carrying cold coastal upwelling water into the ocean are inferred from satellite data and in situ measurements. The conditions leading to the formation of transverse jets are discussed in detail. It is shown that jet generation is possible wherever a source of fresh water is available. A novel hypothesis is advanced which attributes the origin of transverse jets to instability in the outer front of a coastal upwelling. An infrared NOAA-5 image showing a zone of coastal upwelling off the California-Oregon coast is provided. I.H.

A86-22553

DETERMINATION OF THE OPTICAL PARAMETERS OF THE LAND, OCEAN, AND ATMOSPHERE USING THE DATA OBTAINED ON BOARD THE SATELLITES INTERCOSMOS-20 AND INTERCOSMOS-21 [OPREDELENIE OPTICHESKIKH PARAMETROV ZEMNOI POVERKHNOSTI, OKEANA I ATMOSFERY SO SPUTNIKOV 'INTERKOSMOS-20 I -21']

V. V. BADAEV, M. S. MALKEVICH (AN SSSR, Institut Kosmicheskikh Issledovanii, Moscow, USSR), B. C. PIESIK, and G. ZIMMERMANN (Deutsche Akademie der Wissenschaften, Institut fuer Raumforschung, Berlin, East Germany) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Sept.-Oct. 1985, p. 18-29. In Russian. refs

The results of a joint experiment conducted by the Soviet Union and East Germany in connection with the Intercosmos program are presented. The goals of the experiment were: to analyze satellite data concerning water surface spectral reflectance in order to identify regions of high biological productivity; to assess the manner in which atmospheric turbidity affects remotely sensed data; and to verify methods determining the optical parameters of the atmosphere above the ocean. A brief description of the instrumentation and methodology of the experiment is given, and some examples of the remotely sensed data are presented. It is shown that the effects of the atmosphere on remotely sensed data can be estimated to within 15-20 percent. I.H.

A86-23119*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CHARACTERISTICS OF ARCTIC WINTER SEA ICE FROM SATELLITE MULTISPECTRAL MICROWAVE OBSERVATIONS

J. C. COMISO (NASA, Goddard Space Flight Center, Greenbelt, MD) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Jan. 15, 1986, p. 975-994. NASA-supported research. refs

A coplanarity test using three scanning multichannel microwave radiometer channels shows the potential as well as the limitation of the sensor in discriminating different ice types. However, the capability for accurate determination of sea ice concentration, especially in the central Arctic, is evident from scatter plots of the emissivities using the two polarizations at 37 GHz. The consolidated ice data in the central Arctic form a very compact and linear set of points in these plots, and they slope the same way throughout the winter of 1979 and in other years (1980-1984). An ice concentration algorithm based on the utilization of this slope (about 1.03) is developed that yields retrieved values with an accuracy of about 5 percent in the central Arctic and 10 percent in the seasonal sea ice region. The total areal ice extent and actual ice cover were also derived from ice concentration retrieved by using the algorithm, and the results from several years of midwinter data show a relatively stable ice cover in the northern hemisphere. Author

A86-23291

COMPARISON OF SEA SURFACE TEMPERATURES OBTAINED FROM AN AIRCRAFT USING REMOTE AND DIRECT SENSING TECHNIQUES

P. A. SPYERS-DURAN (National Center for Atmospheric Research, Boulder, CO) and C. D. WINANT (California, University, La Jolla) Journal of Atmospheric and Oceanic Technology (ISSN 0739-0572), vol. 2, Dec. 1985, p. 667-671. refs
(Contract NSF OCE-83-10639)

A comparison of sea surface temperatures is made between aircraft precision radiation thermometer (PRT-5) and aircraft deployed expendable bathythermographs (AXBT) drops. These observations were obtained using the NCAR King Air aircraft for an experiment in the Gulf of California during March 1984. The average difference between the sea surface temperatures reported by the first temperature observed in each AXBT drop and the PRT-5 is -0.07 C with a standard deviation of 0.57 C. The difference in temperature between the two observations increases at lower wind speeds. Based on 116 case studies, differences of 1-2 C exist between the surface and the upper meter of the ocean when wind speeds are less than 5 m/s. Author

A86-24190

ERRORS IN MEASURING ICE THICKNESS BY AIRBORNE RADAR

V. V. BOGORODSKII and A. G. OGANESIAN (Arkticheskii i Antarkticheskii Nauchno-Issledovatel'skii Institut, Leningrad, USSR) (Zhurnal Tekhnicheskoi Fiziki, vol. 55, June 1985, p. 1159-1162) Soviet Physics - Technical Physics (ISSN 0038-5662), vol. 30, June 1985, p. 660-662. Translation. refs

It is shown that existing methods for measuring ice thickness by means of radar do not yield acceptable error estimates due to the lack of calibration methods and measuring standards. Some techniques for estimating rms errors are proposed. I.H.

A86-24773

TOPOGRAPHIC FEATURES OF THE BRISTOL CHANNEL SEA-BED - A COMPARISON OF SEASAT (SYNTHETIC APERTURE RADAR) AND SIDE-SCAN SONAR IMAGES

P. T. HARRIS, M. B. COLLINS, A. E. JAMES (Swansea, University College, Wales), and G. M. ASHLEY (Rutgers University, New Brunswick, NJ) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Jan. 1986, p. 119-136. refs

Side-scan sonar data collected in 1977 and 1983 from the Bristol Channel are compared with 1978 SEASAT images, in order to determine the limiting physical dimensions of positive and negative topographic features detectable by SEASAT. The identification of sea-bed topography is related to a change in current speed which, in turn, is controlled by the relief: water-depth ratio. In a water depth of 45 m with a surface current speed of about 70 cm/s, for example, features greater than 11 m in relief and with a spacing greater than 500 m are visible. The widths of tone-change bands on SEASAT images are found to be related to the 'effective' widths of the topographic features that are modifying the flow conditions. The tone-change band sequence is related to positive and negative relief of the bed, under a particular current direction. Author

A86-24775

THE SATURATION OF LANDSAT MSS DETECTORS OVER LARGE ICE MASSES

J. A. DOWDESWELL (Cambridge University, England) and N. F. MCINTYRE (London, University College, Dorking, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Jan. 1986, p. 151-164. NERC-supported research. refs

A model predicting the spatial and temporal pattern of Landsat Multispectral Scanner (MSS) detector saturation over the snow-covered surface of large ice masses is described. The relationship between MSS recorded radiance and the changes in sun elevation is analyzed. It is observed that MSS band five becomes saturated at the lowest sun angles; however, band seven remains unsaturated. The effects of atmospheric haze, the magnitude and orientation of surface slopes, variations in MSS radiometric calibration, and snow surface characteristics on detector saturation are studied. The spatial and temporal pattern of detector saturation is useful in the scheduling by NASA of the optimum periods to collect unsaturated MSS data of the polar regions. I.F.

A86-24934

REMOTE SENSING OF ATMOSPHERIC WATER VAPOUR FROM BHASKARA II SAMIR DATA AND ITS COMPARISON WITH NOAA-7 WATER VAPOUR DATA

P. N. PATHAK, B. S. GOHIL, and A. SARKAR (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India) Indian Academy of Sciences, Proceedings (Earth and Planetary Sciences) (ISSN 0370-0089), vol. 94, Nov. 1985, p. 237-247. refs

Applying the method of 'statistical linear regression', atmospheric water vapour over oceanic areas has been estimated from the 19 GHz and 22 GHz data of the satellite microwave radiometer (SAMIR) system onboard the Bhaskara II satellite. In the absence of any simultaneous in situ measurements on water vapour over ocean, the SAMIR-derived water vapour data have been compared with like data from the NOAA-7 satellite. It is suggested that a positive bias seen in the SAMIR data could be due to calibration errors in the basic data. In view of the observed bias, the original regression equation is modified and then used to obtain water vapour distributions over ocean for winter and south-west monsoon seasons using SAMIR data of several orbits. Author

A86-25017

RECONNAISSANCE AND INTERPRETATION OF SEA COLORS [ERKUNDUNG UND INTERPRETATION DER MEERESFARBEN]

H. VAN DER PIEPEN, V. AMANN, and R. FIEDLER (DFVLR, Institut fuer Optoelektronik, Oberpfaffenhofen, West Germany) DFVLR-Nachrichten (ISSN 0011-4901), Nov. 1985, p. 21-26. In German. refs

Relations between the optical properties of water and the physical parameters of the water provide a basis for a study of oceans and other bodies of water. The present paper is concerned with the physical basis of such studies, their significance, history, the current state-of-the-art, and research undertaken to perfect the required technology, taking into account, in particular, the utilization of satellite-borne sensors. A great breakthrough with respect to water-color based remote sensing activities was made when the Coastal Zone Color Scanner (CZCS) on the satellite Nimbus-7 began to provide data in 1978. These data are extending the applications of remote sensing to entirely new areas, giving attention to important contributions regarding the study of the oceans and their economic utilization. Attention is given to research and development work conducted by the DFVLR in relation to the technology of ocean color analysis, the principles of measurement, the classification of different types of water, sensor technologies, applications, and future space missions. G.R.

A86-25371

EXTRACTION OF THE M2 OCEAN TIDE FROM SEASAT ALTIMETER DATA

P. L. WOODWORTH and D. E. CARTWRIGHT (Bidston Observatory, Birkenhead, England) Geophysical Journal (ISSN 0016-8009), vol. 84, Feb. 1986, p. 227-255. refs

Three complementary methods for the extraction of the M2 ocean tide using Seasat altimetry are presented and compared. The first method (that developed by Cartwright and Alcock), which provides 'point measurements' of the tide at the crossovers of the Seasat repeat orbit ground track, has been applied to a study of the tide in tropical ocean areas. The other two methods involve spatial expansions of M2 in terms of either surface spherical harmonics (in the case of the method developed by Mazzega) or Platzman normal modes of the world ocean. The results obtained by each method from only one month of Seasat data reproduce many features of the tide represented in recent tidal models, and promise well for satellite altimetry as a future source of tidal knowledge. Author

A86-26201* Florida State Univ., Tallahassee.

THE FRONTAL AIR-SEA INTERACTION EXPERIMENT (FASINEX). II - EXPERIMENTAL PLAN

S. A. STAGE (Florida State University, Tallahassee) and R. A. WELLER (Woods Hole Oceanographic Institution, MA) American Meteorological Society, Bulletin (ISSN 0003-0007), vol. 67, Jan. 1986, p. 16-20. Navy-NSF-NASA-NOAA-supported research.

The Frontal Air-Sea Interaction Experiment (FASINEX) is a study of the response of the upper ocean to atmospheric forcing in the vicinity of an oceanic front in the subtropical convergence zone southwest of Bermuda, the response of the lower atmosphere in that vicinity to the oceanic front, and the associated two-way interaction between ocean and atmosphere. FASINEX is planned for the winter and spring of 1985-1986 with an intensive period in February and March 1986 in the vicinity of 27 deg N, 70 deg W, where sea-surface temperature fronts are climatologically common. Measurements will be made from buoys, ships, aircraft, and spacecraft. A previous article gave a brief history of FASINEX and presented its scientific goals. This article describes the FASINEX experimental plan. Author

A86-27976

NATIONAL GROUP FOR THE PHYSICS OF THE ATMOSPHERE AND THE OCEANS, CONGRESS, 1ST, ROME, ITALY, JUNE 19-22, 1984, PROCEEDINGS [GRUPPO NAZIONALE PER LA FISICA DELL'ATMOSFERA E DELL'OCEANO, CONGRESSO, 1ST, ROME, ITALY, JUNE 19-22, 1984, PROCEEDINGS]

Nuovo Cimento C, Serie 1 (ISSN 0390-5551), vol. 8 C, Nov.-Dec. 1985, 392 p. In Italian and English. For individual items see A86-27977 to A86-27991.

Various papers on geophysics and space physics are presented. The topics discussed include: cooling processes and temperature profiles during nocturnal inversions, Nimbus 7 CZCS images as inputs in circulation modelling of the North Adriatic Sea, comparison of measured and calculated high-resolution spectra of far-infrared stratospheric emission, implications for the atmospheric sulfur budget of two-dimensional distributions of sulfur compounds in the troposphere, stratospheric heating due to El Chichon volcanic eruption, and measurements of atmospheric turbulence strength by coherent optical scintillation. Also considered are: study of stratospheric aerosol loading by lidar analysis of long and short-time fluctuations, stratospheric ozone descent into the troposphere, remote sensing of oils on the sea surface with an airborne infrared scanner, sea surface temperature from AVHRR-2 data, fine-mesh objective analysis scheme in isentropic coordinates, integrating nephelometer performance in fog and thick haze, and measurement and analysis of scattered radiation by a variable fov transmissometer. C.D.

A86-27985

REMOTE SENSING OF OILS ON THE SEA SURFACE WITH AN AIRBORNE INFRA-RED SCANNER

F. CASTAGNOLI, L. PANTANI, I. PIPPI, and B. RADICATI (CNR, Istituto di Ricerca sulle Onde Elettromagnetiche, Florence, Italy) (Gruppo Nationale per la Fisica dell'Atmosfera e dell'Oceano, Congresso, 1st, Rome, Italy, June 19-22, 1984) Nuovo Cimento C, Serie 1 (ISSN 0390-5551), vol. 8 C, Nov.-Dec. 1985, p. 762-770. refs

The ability of an infrared sensor to detect oil spills over the sea surface is discussed on the basis of the first results of the Archimedes experiment of 1983. Two oil spills were made about 9 km apart, one consisting of pure fuel oil and the other of a stabilized mixture of fuel oil and water. The oil spill detection process is discussed, the experiment is summarized, and the image analysis is described. Images with different processing are shown. The results demonstrate the ability of an infrared scanner to monitor oil spills on the sea surface in real time during day or night. The only requirement is a transparent atmosphere. C.D.

A86-28064

ACOUSTIC OCEANOGRAPHY BY REMOTE SENSING

J. A. MERCER (Washington, University, Seattle) IEEE Journal of Oceanic Engineering (ISSN 0364-9059), vol. OE-11, Jan. 1986, p. 51-57. refs

The use of remotely stationed acoustic devices to study the interior of oceans is examined. The ocean-acoustic tomography method developed by Munk and Wunsch (1979) for remote monitoring of ocean basins for mesoscale and basin-scale variability is described. The applicability of ocean-acoustic tomography is evaluated in an experiment conducted in 1981. Calculated travel-time measurements are compared with speed-sound measurements derived from conductivity-temperature-depth/expendable bathythermographs of the tomography area. The problems encountered with the monitoring equipment during the experiment are discussed. It is observed that the limited tomographic results correlate with the speed-sound data. The tomography data is interpreted using the Cornuelle et al. (1975) stochastic inverse procedure. The sound-speed contour maps produced are accurate for a depth of 700 m; however, they degrade toward the ocean surface and bottom. The application of satellite altimeters and scatterometers, and gyrescale tomography to oceanography is proposed. I.F.

A86-28601* Washington Univ., Seattle.

ON SATELLITE SCATTEROMETER CAPABILITIES IN AIR-SEA INTERACTION

R. A. BROWN (Washington, University, Seattle) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Feb. 15, 1986, p. 2221-2232. refs

(Contract NAGW-303)

The verified capabilities and some practical usage of the satellite scatterometer in geophysical data production have demonstrated the value of this instrument. This evaluation of scatterometer ability to measure marine winds includes the scatterometer verification data, the state of the art planetary boundary layer model relating the wind profile in the atmosphere to the surface stress, and the pertinent results of the Storms Response Experiment. Author

A86-28607* Remote Sensing Systems, Sausalito, Calif.

NEW ALGORITHMS FOR MICROWAVE MEASUREMENTS OF OCEAN WINDS APPLICATIONS TO SEASAT AND THE SPECIAL SENSOR MICROWAVE IMAGER

F. J. WENTZ, L. A. MATTOX (Remote Sensing Systems, Sausalito, CA), and S. PETEHERYCH (Department of the Environment, Atmospheric Environment Service, Downsview, Canada) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Feb. 15, 1986, p. 2289-2307. Previously announced in STAR as N84-27272. refs

(Contract NASW-3606; N00014-83-C-0520)

Improved second generation wind algorithms are used to process the three month Seasat SMMR and SASS data sets. The new algorithms are derived without using in situ anemometer measurements. All known biases in the sensors prime measurements are removed, and the algorithms prime model functions are internally self-consistent. The computed SMMR and SASS winds are collocated and compared on a 10 km cell-by-cell basis, giving a total of 115444 wind comparisons. The comparisons are done using three different sets of SMMR channels. When the 6.6H SMMR channel is used for wind retrieval, the SMMR and SASS winds agree to within 1.3 m/s over the SASS primary swath. At nadir where the radar cross section is less sensitive to wind, the agreement degrades to 1.9 m/s. The agreement is very good for winds from 0 to 15 m/s. Above 15 m/s, the off-nadir SASS winds are consistently lower than the SMMR winds, while at nadir the high SASS winds are greater than SMMR's. When 10.7H is used for the SMMR wind channel, the SMMR/SASS wind comparisons are not quite as good. When the frequency of the wind channel is increased to 18 GHz, the SMMR/SASS agreement substantially degrades to about 5 m/S. Author

A86-28608

STRUCTURE OF THE SURFACE WIND FIELD FROM THE SEASAT SAR

T. W. GERLING (Johns Hopkins University, Laurel, MD) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Feb. 15, 1986, p. 2308-2320. Research supported by Johns Hopkins University. refs

The instruments carried by Seasat included a synthetic aperture radar (SAR) which is capable of producing radar images of both land and ocean with 25-m resolution. It is pointed out that any geophysical process which influences the 30-cm Bragg waves on the ocean surface will produce a signature in SAR imagery. The extraction of ocean surface wind speed and direction information from SAR imagery is discussed for a particular Seasat data set, taking into account pass 1339. The SAR wind direction signature is based on the kilometer-scale variation of SAR backscatter detectable through analysis of SAR image spectra. Attention is given to the Seasat pass 1339 data set, wind speed estimates with SAR, wind field estimates derived from SAR 6.4-km imagery, and a comparison of wind field estimates. G.R.

A86-28611*   Johns Hopkins Univ., Laurel, Md.

ALTIMETER HEIGHT MEASUREMENT ERROR INTRODUCED BY THE PRESENCE OF VARIABLE CLOUD AND RAIN ATTENUATION

F. M. MONALDO, J. GOLDHIRSH (Johns Hopkins University, Laurel, MD), and E. J. WALSH (NASA, Wallops Flight Center, Wallops Island, VA)   Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Feb. 15, 1986, p. 2345-2350. Previously announced in STAR as N84-27289.   refs

It has recently been recognized that spatially inhomogeneous clouds and rain can substantially affect the height precision obtainable from a spaceborne radar altimeter system. Through computer simulation, it has been found that typical levels of cloud and rain intensities and associated spatial variabilities may degrade altimeter precision at 13.5 GHz and, in particular, cause severe degradation at 35 GHz. This degradation in precision is a result of radar signature distortion caused by variable attenuation over the beam limited altimeter footprint. Because attenuation effects increase with frequency, imprecision caused by them will significantly impact on the frequency selection of future altimeters. In this paper the degradation of altimeter precision introduced by idealized cloud and rain configurations as well as for a realistic rain configuration as measured with a ground based radar is examined. B.W.

A86-28613*   Johns Hopkins Univ., Laurel, Md.

SATELLITE TECHNIQUES FOR DETERMINING THE GEOPOTENTIAL OF SEA SURFACE ELEVATIONS

V. L. PISACANE (Johns Hopkins University, Laurel, MD)   Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Feb. 15, 1986, p. 2365-2371. NASA-supported research. Previously announced in STAR as N84-27298.   refs

Spaceborne altimetry with measurement accuracies of a few centimeters which has the potential to determine sea surface elevations necessary to compute accurate three-dimensional geostrophic currents from traditional hydrographic observation is discussed. The limitation in this approach is the uncertainties in knowledge of the global and ocean geopotentials which produce satellite and height uncertainties about an order of magnitude larger than the goal of about 10 cm. The quantitative effects of geopotential uncertainties on processing altimetry data are described. Potential near term improvements, not requiring additional spacecraft, are discussed. Even though there is substantial improvements at the longer wavelengths, the oceanographic goal will be achieved. The geopotential research mission (GRM) is described which should produce geopotential models that are capable of defining the ocean geoid to 10 cm and near-earth satellite position. The state of the art and the potential of spaceborne gravimetry is described as an alternative approach to improve our knowledge of the geopotential. E.A.K.

A86-28614#

DYNAMIC TRANSFER OF SIMULATED ALTIMETER DATA INTO SUBSURFACE INFORMATION BY A NUMERICAL OCEAN MODEL

H. E. HURLBURT (U.S. Navy, Naval Ocean Research and Development Activity, Bay St. Louis, MS)   Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Feb. 15, 1986, p. 2372-2400. Navy-sponsored research.   refs

The potential for a global, eddy-resolving oceanic prediction capability within the next decade has been exmined by Hurlburt (1984). The present study is concerned with a prediction system which is mainly based on satellite data, output from atmospheric models, a class VII computer (approximately 100 million words and approximately 1 gigaflop sustained speed), and highly efficient ocean models. Problems regarding the application of altimeter data to ocean circulation prediction are related to spatial and temporal sampling requirements, asynoptic data assimilation, uncertainty in the data including geoid errors, and the inference of subsurface information from the surface data provided by altimeters. Attention is given to the numerical model employed and the parameters, aspects of experimental approach and interpretation, model experiments used as true solutions, and the results form some experiments. G.R.

A86-28615#

ALTIMETER DATA AND GEOID ERROR IN MESOSCALE OCEAN PREDICTION SOME RESULTS FROM A PRIMITIVE EQUATION MODEL

J. D. THOMPSON (U.S. Navy, Naval Ocean Research and Development Activity, Bay St. Louis, MS)   Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Feb. 15, 1986, p. 2401-2417. Navy-supported research.   refs

It is pointed out that the radar altimeter (GEOS 3, Seasat) is the only proven satellite-borne instrument capable of synoptically measuring an integral property of the dynamic ocean on a near-global, all-weather basis. The present paper is mainly concerned with the application of a primitive equation ocean model to the study of sea surface height information derived from an altimeter. It is demonstrated that in the Gulf of Mexico this technique can provide a geoid which is more accurate than that which is currently available from direct calculations on the basis of sparse shipboard gravity data or from an approach involving the differencing of the altimetric mean sea surface with dynamic heights based on available hydrographic data. Attention is given to Gulf of Mexico data, the Gulf of Mexico model, and initialization experiments. G.R.

A86-28616#

SAMPLING STRATEGIES AND MODEL ASSIMILATION OF ALTIMETRIC DATA FOR OCEAN MONITORING AND PREDICTION

J. C. KINDLE (U.S. Navy, Ocean Dynamics and Prediction Branch, Bay St. Louis, MS)   Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Feb. 15, 1986, p. 2418-2432. Navy-supported research.   refs

A one-layer, reduced gravity primitive equation model of the Gulf of Mexico is used in the present examination of altimeter-derived sea surface height assimilations into numerical ocean circulation models for numerical forecasting. The data allow examination of spatial sampling requirements for accurate resolution of oceanic eddies, as well as the assimilation of asynoptic altimeter data into numerical models in the forecast mode. The results obtained indicate that for a stationary circular eddy, approximately two tracks across the eddy are enough to ensure adequate spatial resolution. It is also noted that if the track spacing is sufficient for resolution of the height field of an eddy, the along-track geostrophic velocity component is determined with an accuracy that is equivalent to that of the cross-track component. O.C.

A86-28617*   Johns Hopkins Univ., Laurel, Md.

SPATIAL VARIATIONS OF OCEAN WAVE DIRECTIONAL SPECTRA FROM THE SEASAT SYNTHETIC APERTURE RADAR

R. C. BEAL, T. W. GERLING, D. E. IRVINE, F. M. MONALDO, and D. G. TILLEY (Johns Hopkins University, Laurel, MD)   Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Feb. 15, 1986, p. 2433-2449. Navy-NASA-supported research.   refs

Seasat synthetic aperture radar ocean wave spectra for a 900-km pass are analyzed and interpreted in the context of both their probable generation sources and their surface current and bathymetric modifiers. Systematic vector wavenumber variations of several times the standard error of determination (about 1.5 percent in magnitude and 0.9 deg in direction) occur along the entire 900-km pass. The large-scale spatial variation of a 200-m swell system can be accurately accounted for as a result of dispersion from a distant storm. The more local variations are qualitatively well correlated in position with known currents and bathymetry but show systematic biases that appear partly due to an environmentally dependent instrument transfer function in the regions of high current and highest sea state. There is also substantial evidence that a large angular deviation in the center of the pass is the result of a mesoscale eddy just to the east. Author

A86-28618* Hofstra Univ., Hempstead, N. Y.

MEASUREMENTS OF OCEAN WAVE SPECTRA AND MODULATION TRANSFER FUNCTION WITH THE AIRBORNE TWO-FREQUENCY SCATTEROMETER

D. E. WEISSMAN (Hofstra University, Hempstead, NY) and J. W. JOHNSON (NASA, Langley Research Center, Hampton, VA) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Feb. 15, 1986, p. 2450-2460. Previously announced in STAR as N84-27282. refs

(Contract NAGW-468)

The directional spectrum and the microwave modulation transfer function of ocean waves can be measured with the airborne two frequency scatterometer technique. Similar to tower based observations, the aircraft measurements of the Modulation Transfer Function (MTF) show that it is strongly affected by both wind speed and sea state. Also detected are small differences in the magnitudes of the MTF between downwind and upwind radar look directions, and variations with ocean wavenumber. The MTF inferred from the two frequency radar is larger than that measured using single frequency, wave orbital velocity techniques such as tower based radars or ROWS measurements from low altitude aircraft. Possible reasons for this are discussed. The ability to measure the ocean directional spectrum with the two frequency scatterometer, with supporting MTF data, is demonstrated. M.A.C.

A86-28620* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SATELLITE REMOTE SENSING OVER ICE

R. H. THOMAS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Feb. 15, 1986, p. 2493-2502. NASA-supported research. Previously announced in STAR as N84-27308. refs

Satellite remote sensing provides unique opportunities for observing ice-covered terrain. Passive-microwave data give information on snow extent on land, sea-ice extent and type, and zones of summer melting on the polar ice sheets, with the potential for estimating snow-accumulation rates on these ice sheets. All weather, high-resolution imagery of sea ice is obtained using synthetic aperture radars, and ice-movement vectors can be deduced by comparing sequential images of the same region. Radar-altimetry data provide highly detailed information on ice-sheet topography, with the potential for deducing thickening/thinning rates from repeat surveys. The coastline of Antarctica can be mapped accurately using altimetry data, and the size and spatial distribution of icebergs can be monitored. Altimetry data also distinguish open ocean from pack ice and they give an indication of sea-ice characteristics. Author

A86-28623

PROBLEMS AND FUTURE DIRECTIONS IN REMOTE SENSING OF THE OCEANS AND TROPOSPHERE - A WORKSHOP REPORT

D. ATLAS (Maryland, University, College Park), R. C. BEAL (Johns Hopkins University, Laurel, MD), R. A. BROWN (Washington, University, Seattle), P. DE MEY (Harvard University, Cambridge, MA), R. K. MOORE (Kansas, University, Lawrence) et al. Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Feb. 15, 1986, p. 2525-2548. refs

(Contract NSF ATM-84-14199)

Attempts to identify the gaps and limitations in the ability to remotely sense the oceans and troposphere from air and space platforms are presented. The directions that offer solutions and new opportunities for advancing the state of the art are set down. The needs are clearly related to the scientific problems. Special attention is given to the synergistic benefits of simultaneous observations because of the interdependence of the remotely sensed parameters and the problem areas to which they are directed. Emphasis is also given to the adaptation of spaceborne remote sensing to aircraft platforms and vice versa. The problem areas covered are (1) directional ocean wave spectra, (2) ocean surface winds, (3) ocean circulation, (4) sea ice, (5) a subset of atmospheric measurements, and (6) air-sea interaction. Author

A86-28624* California Univ., La Jolla.

ON CROSSOVER ADJUSTMENT IN SATELLITE ALTIMETRY AND ITS OCEANOGRAPHIC IMPLICATIONS

C.-K. TAI (California University, La Jolla) and L.-L. FU (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Feb. 15, 1986, p. 2549-2554. refs

(Contract NAGW-663)

It is argued that, to remove the satellite orbital errors, the crossover adjustment method that represents orbital errors in terms of Fourier series is preferable to the conventional bias-and-tilt crossover adjustment method. However, no matter what technique is used in the crossover adjustment, orbital errors will introduce a geographically dependent error (mostly a large-scale slope, which, in terms of spherical harmonics, is represented by the degree 1 terms) into the derived sea surface topography. This is because the responsible orbital errors have left no traces in crossover differences and therefore can never be removed. However, it is possible to reduce this fundamental uncertainty substantially if the record length is long enough; its implications on observing the basin-scale ocean circulation by satellite altimetry are discussed. New methods for observing the large-scale oceanic variability are also proposed (the conventional approach being limited to observing the mesoscale variability). Author

A86-28626

PERSISTENCE OF A PATTERN OF SURFACE GRAVITY WAVES

K. M. WATSON (California, University, San Diego) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Feb. 15, 1986, p. 2607-2615. Research supported by the Mitre Corp. refs

(Contract F19628-84-C-0001; N00014-79-C-0472)

The observation of ship Kelvin wakes by the Seasat synthetic aperture radar raises a question concerning the persistence of patterns of surface gravity waves. Time scales vary with wavelength and environmental conditions. The range extends from fractions of a second at the shortest wavelengths to many days for ocean swell. Several mechanisms for destroying a wave pattern are investigated here. These are viscous dissipation, direct wind-wave interaction, and nonlinear hydrodynamic interaction with ambient surface waves. The nonlinear hydrodynamic interactions appear to be the most significant. Author

A86-28629

ASPECTS OF WARM RINGS IN THE GULF OF MEXICO

F. M. VUKOVICH and B. W. CRISSMAN (Research Triangle Institute, Research Triangle Park, NC) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Feb. 15, 1986, p. 2645-2660. Research supported by the Science Applications International Corp. refs

The paths, speed, and decay of major warm rings that separate from the Loop Current are studied using satellite infrared and Ship-of-Opportunity data. It is observed that after the warm rings separate they move into the western portion of the Gulf of Mexico following a northern, midgulf, or southwestern path. The oscillations in the speed of the rings, which ranges from 1-6 km/day for 40-100 days, are analyzed. A description of the two ring decay process which involve erosion of the rings at the boundaries and the separation of smaller rings from the main ring is provided. It is detected that the surface areas of the rings decrease to 55 percent of their original size after 150 days and to 31 percent of their size in 300 days. I.F.

N86-16685# National Oceanic and Atmospheric Administration, Boulder, Colo.

MARGINAL ICE ZONE BIBLIOGRAPHY

Jun. 1985 199 p

(PB85-242493; GD-17) Avail: NTIS HC A09/MF A01 CSCL 08L

A major bibliography on sea ice, meteorology and oceanography in the marginal ice zone is provided. It has been recognized in the last few years that processes of air-ice-ocean interaction occurring near the boundary of ice-covered seas are of critical importance to our understanding of the mechanisms of seasonal ice growth and decay and short and long term anomalies in ice extent. Oil and gas exploration and development are increasingly being conducted in areas with seasonal ice cover and the ice margin is also a zone of high productivity by marine biota. Until recently, opportunities to conduct research in the marginal ice zone (MIZ) were limited by available technology, but a major international marginal ice zone experiment (MIZEX) is underway in the Bering Sea and the East Greenland Sea and results from this work are now beginning to appear in the literature. GRA

N86-16897*# Oklahoma Univ., Norman. Cooperative Inst. for Mesoscale Meteorological Studies.
DEVELOPMENT OF THE VARIATIONAL SEASAT DATA ANALYSIS TECHNIQUE Final Report
Y. K. SASAKI, L. P. CHANG, and J. S. GOERSS Dec. 1985 80 p refs
(Contract NAG5-289)
(NASA-CR-176471; NAS 1.26:176471) Avail: NTIS HC A05/MF A01 CSCL 05B

Surface winds are closely associated with the surface pressure gradient. The variational SEASAT data analysis technique was designed to improve the sea level pressure analysis in the data sparse areas. The SEASAT-derived surface wind data were compared with observations from the Joint Air Sea Interaction Experiment (JASIN) and it was found that the satellite-derived sea surface wind has an accuracy of up to + or - 2 m/s in speed and + or - 20 deg in direction. These numbers are considered characteristic of the retrieved SEASAT wind field. By combining the densely spaced SEASAT-derived wind data with the sparsely distributed sea-level pressure observation via a variational adjustment technique subject to some appropriate physical constraint(s), an improvement in the sea-level pressure analysis is expected. It is demonstrated that a simple marine boundary layer scheme in conjunction with a variational adjustment technique can be developed to help improve the sea-level pressure analysis by the SEASAT-derived wind of a limited-area domain in the ocean. E.A.K.

N86-16855*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SATELLITE-DERIVED SEA SURFACE TEMPERATURE: WORKSHOP 3
15 Oct. 1985 181 p refs Workshop held in Pasadena, Calif., 22-24 Feb. 1984 Original contains color illustrations 3 Vol.
(Contract NAS7-918)
(NASA-CR-176455; JPL-PUB-85-63; NAS 1.26:176455) Avail: NTIS HC A09/MF A01 CSCL 08J

This is the third of a series of three workshops, sponsored by the National Aeronautics and Space Administration, to investigate the state of the art in global sea surface temperature measurements from space. Three workshops were necessary to process and analyze sufficient data from which to draw conclusions on the accuracy and reliability of the satellite measurements. In this workshop, the final two (out of a total of four) months of satellite and in situ data chosen for study were processed and evaluated. Results from the AVHRR, HIRS, SMMR, and VAS sensors, in comparison with in situ data from ships, XBTs, and buoys, confirmed satellite rms accuracies in the 0.5 to 1.0 C range, but with variable biases. These accuracies may degrade under adverse conditions for specific sensors. A variety of color maps, plots, and statistical tables are provided for detailed study of the individual sensor SST measurements.

N86-16856*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DATA SETS AND PRODUCTS
J. E. HILLAND and E. G. NJOKU *In its* Satellite-Derived Sea Surface Temperature 12 p 15 Oct. 1985 refs
Avail: NTIS HC A09/MF A01 CSCL 08J

Against background of spacecraft and in situ measurements, participants at the JPL workshops sought to review the sensor performance, understand the different SSt retrieval algorithms, evaluate the sensor SST accuracies, and discuss directions for future sensor development. The issue of utilization of satellite SSTs in climate, air sea interaction, and mesoscale oceanography studies was not the main focus of the workshops, but did have a bearing on the recommendations that arose from the discussions. More date were available for analysis with the acquisition of AVHRR (MCSST), HIRS/MSU, and VAS data sets. In Workshop 3 the acquisition and analysis fo data were completed, recommendations for future research and sensor development were discussed, and plans were made for eventual publication of results from the workshop series in the open literature. Author

N86-16857*# National Oceanic and Atmospheric Administration, Washington, D. C. National Environmental Satellite, Data, and Information Service.
ADVANCED VERY HIGH RESOLUTION RADIOMETER (AVHRR) SENSOR COMPARISON CHARACTERISTICS
E. P. MCCLAIN *In* JPL Satellite-Derived Sea Surface Temperature 17 p 15 Oct. 1985 refs
Avail: NTIS HC A09/MF A01 CSCL 08J

Advantages and limitations of the AVHRR multichannel sea surface temperature (MCSST) detecting technique using NOAA satellites are discussed. The error characteristics of MCSST's from statistical tables and regional AVHRR error characteristics from global anomaly charts are also discussed. Some soruces of errors and positive findings are reviewed. E.R.

N86-16858*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RETRIEVAL OF SEA-SURFACE TEMPERATURES FROM HIRS2/MSU
J. SUSSKIND and D. REUTER *In* JPL Satellite-Derived Sea Surface Temperature 18 p 15 Oct. 1985 refs
Avail: NTIS HC A09/MF A01 CSCL 08J

The methods used at the Goddard Laboratory for Atmospheres to retrieve sea surface temperatures from HIRS2/MSU data for the four months of the NASA sea surface temperature intercomparison workshop are described. Results are shown comparing anomaly fields produced using data from ships, AVHRR, HIRS2/MSU, SMMR AND VAS for the last three of these months. Fields from AVHRR and HIRS2 show the highest accuracy compared to ship fields. Errors in the HIRS2 fields appear more random while AVHRR data shows large area, spatially coherent errors. The random errors in the HIRS2 fields can be further reduced by performing the retrievals at a higher spatial resolution. Author

N86-16859*# Wisconsin Univ., Madison. Space Science and Engineering Center.
SEA SURFACE TEMPERATURES FROM VAS MSI DATA
J. J. BATES *In* JPL Satellite-Derived Sea Surface Temperature 7 p 15 Oct. 1985 refs
Avail: NTIS HC A09/MF A01 CSCL 08J

The results of the SST intercomparison workshop series are the first examination of monthly mean SSTs derived from MSI data provided by the VAS instrument on the GOES series satellites. The most significant change in deriving the SST's was the use of the three window channel algorithm in the processing of the July data as opposed to the use of only the two window channel algorithm for the March data. In addition, further satellite/buoy matches indicated that the triple window channel algorithm showed a smaller standard deviation than the two window channel algorithm and was less sensitive to the effects of volcanic aerosol contamination and low level inversion conditions. This is due to the smaller brightness temperature attenuation by aerosols and water vapor at 3.9 microns than at 11.0 and 12.6 microns. Thus, the decision was made to use the best product (i.e., the three window channel agloritm) for processing the July data. Author

N86-16860*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BLENDED SST FIELDS COMBINED SMMR/SHIP DATA (SUMMARY OF TECHNIQUE)
T. T. WILHEIT and D. HAN (Systems and Applied Sciences Corp., Hyattsville, Md.) *In* JPL Satellite-Derived Sea Surface Temperature 5 p 15 Oct. 1985 refs
Avail: NTIS HC A09/MF A01 CSCL 08J

All remote sensors have bias problems which vary in space and time. The infrared measurements are very sparse in cloudy areas: the SMMR has coverage limitations due to the interference of land areas and only half time operation. If one simply averaged the data from these various sources, the combination of the biases and varying sampling would introduce artifacts into the analyzed product which would reflect the sampling and which could be quite misleading. The remote sensors provide reasonable estimates of gradients of SST over length scales greater than the sensor resolution but smaller than hemispheric. Ships can be considered unbiased but are poorly distributed on small scales except in the densest shipping lanes. An analysis scheme based on a suggestion by Holl was developed which exploits just this approximately complementarity to provide an improved SST analysis. The resulting accuracy appears to be in the required approx. 0.5 C range for the particular case of using SMMR and ship data to produce two degree latitude by two degrees longitude monthly analyses. Author

N86-16861*# Scripps Institution of Oceanography, La Jolla, Calif.
INTERCOMPARISON OF GLOBAL SST FIELDS DERIVED FROM SATELLITE SENSORS AND SHIP OBSERVATIONS
S. E. PAZAN *In* JPL Satellite-Derived Sea Surface Temperature 13 p 15 Oct. 1985 refs
Avail: NTIS HC A09/MF A01 CSCL 08J

Near global comparisons were made between binned forms of SST obtained from different instruments, ship meteorological observations, and the output of a meteorological model. Binning hereinafter means gridding by simple summation of data values in a bin, which in this study was a 2 deg. x 2 deg. box or a 10 deg. x 10 box surrounding a grid node. In the binned comparisons, the question is asked: are the binned data from two instruments drawn from the same population? The first two measures of statistical moments of the populations are used to test the hypothesis that they are. Comparisons were also attempted between raw forms of the various SST retrievals, using a structure function analysis. The results of this analysis were relatively uninteresting and are therefore omitted. Author

N86-16862*# Western Australian Inst. of Tech., Bentley. School of Physics and Geosciences.
REQUIREMENTS FOR SEA SURFACE TEMPERATURE GROUND TRUTH IN THE INDONESIAN REGION
J. PENROSE *In* JPL Satellite-Derived Sea Surface Temperature 2 p 15 Oct. 1985 refs
Avail: NTIS HC A09/MF A01 CSCL 08J

The comparatively low density of ship and XBT observations in large areas of the Southern Hemisphere and the tropics limits the extent to which satellite SST estimates can be validated on a global basis. These limitations are discussed, and some recommendations for correction are given. E.R.

N86-16873# SES, Inc., Springfield, Va.
PATHWAYS AND FUTURE DIRECTIONS FOR ENVIRONMENTAL DATA AND INFORMATION USERS
Oct. 1984 433 p Proceedings of conference held in Denver, Colo., 19-22 Aug. 1984
(Contract NA83-SA-C-00754)
(PB85-233377; NESDIS-CONF-84-2) Avail: NTIS HC A19/MF A01 CSCL 08J

The interdisciplinary use of environmental data and information available from NOAA's National Environmental Satellite, Data, and Information Services (NESDIS) data centers are presented. Topical areas include activities as: (1) legal and insurance industries; (2) business, commodities, manufacturing, travel and recreation, (3) public and environmental health; (4) communications; (5) the marine environment, research and academia; disaster preparedness, and resource management. Future plans for on-line services and the technology transfer program of NOAA are described. GRA

N86-16874# National Oceanic and Atmospheric Administration, Washington, D. C. Oceanographic and Meteorological Labs.
ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LABORATORY, FISCAL YEAR 1984 Annual Report
Jan. 1985 62 p
(PB85-218014) Avail: NTIS HC A04/MF A01 CSCL 08C

The mission NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML) is to conduct a basic and applied research program in oceanography characteristics and processes of the ocean and the atmosphere both separately and as a coupled system. Oceanographic investigations center on the fluxes of energy, momentum, and materials through the air-sea interface; the transport and composition (thermal and chemical) of water in the ocean volume; and hydrothermal processes of mineralization at seafloor spreading centers. Meteorological research is carried out to improve the description, understanding, and prediction of hurricanes. GRA

N86-17722# Rijkswaterstaat, The Hague (Netherlands). Meetkundige Dienst.
THE UTILIZATION OF FALSE COLOR AERIAL PHOTOGRAPHY FOR MACROPHYTE BIOMASS ESTIMATION IN THE OOSTERSCHELDE (THE NETHERLANDS) [HET GEBRUIK VAN FALSE COLOURLUCHTFOTOGRAFIE BIJ DE SCHATTING VAN DE MACROFYTENBIOMASSA IN DE OOSTERSCHELDE]
C. MEULSTEE and H. VANSTOKKOM Jan. 1985 28 p refs In DUTCH
(MDLK-R-8509) Avail: NTIS HC A03/MF A01

The correlation between the biomass of sea grass and seaweed samples in a sidebranch of the Oosterschelde delta (Netherlands) and density ratios of this area on color infrared aerial photographs was investigated. As the Oosterschelde will become more divided from the North Sea after pier dam completion, an increase of macrophytes is expected. In an area where the weeds Ulva, Cheatomorpha, Entermorpha, Cladophora, Fucus vesuculosis, and the grasses Zostera noltii and Zostera marina are found, 53 biomass samples of a 0.054 sq m surface each were collected. The relation between covering degree and biomass was estimated. Using a transmission-densitometer adjusted to 3 to 1 mm, densities on 1:10,000 and 1:20,000 scale photographs were measured. A gage line was determined in a density-biomass diagram. The method is shown to be useful for an efficient, accurate biomass determination in the Oosterschelde. Author (ESA)

N86-17817*# National Aeronautics and Space Administration, Washington, D.C.
SATELLITE REMOTE SENSING FOR ICE SHEET RESEARCH
R. H. THOMAS, R. A. BINDSCHADLER (NASA, Goddard Space Flight Center, Greenbelt, Md.), R. L. CAMERON (NSF, Washington, D.C.), F. D. CARSEY (JPL, Pasadena, Calif.), B. HOLT (JPL, Pasadena, Calif.), T. J. HUGHES (Maine Univ.), C. W. M. SWITHINBANK (British Antarctic Survey, Cambridge, England), I. M. WHILLANS (Ohio State Univ.), and H. J. ZWALLY (NASA, Goddard Space Flight Center, Greenbelt, Md.) Nov. 1985 40 p refs Original contains color imagery. Original photographs may be purchased from the EROS Data Center, Sioux Falls, S.D. 57187 ERTS
(E86-10024; NASA-TM-86233; REPT-85F0298; NAS 1.15:86233)
Avail: NTIS HC A03/MF A01 CSCL 08L

Potential research applications of satellite data over the terrestrial ice sheets of Greenland and Antarctica are assessed and actions required to ensure acquisition of relevant data and appropriate processing to a form suitable for research purposes are recommended. Relevant data include high-resolution visible and SAR imagery, infrared, passive-microwave and scatterometer measurements, and surface topography information from laser and radar altimeters. Author

N86-17823# University Coll., London (England). Mullard Space Science Lab.
APPLICATIONS AND SCIENTIFIC USES OF ERS-1 RADAR ALTIMETER DATA Final Report
C. G. RAPLEY, H. D. GRIFFITHS, V. A. SQUIRE (Cambridge Univ.), J. G. OLLIVER (Oxford Univ.), A. R. BIRKS (Science and Engineering Research Council, Chilton, England), A. P. R. COOPER (Cambridge Univ.), A. M. COWAN (Cambridge Univ.), D. J. DREWRY (Cambridge Univ.), M. R. GORMAN (Cambridge Univ.), M. GUZKOWSKA (Oxford Univ.) et al. Paris ESA Feb. 1985 276 p refs
(Contract ESTEC-5684/83/NL-BI)
(ESA-CR(P)-2084) Avail: NTIS HC A13/MF A01

Applications of the ERS-1 pulse-limited radar altimeter dedicated to observations of oceans and ice are discussed. Areas in which the ERS-1 altimeter is likely to be most effective are indicated. Status of the data analysis techniques and the limitations imposed by the design of the altimeter system are described. A concept for the use of altimeter data from lakes for climate research, and work on the altimetry of coastal regions are summarized.
Author (ESA)

N86-17970# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
BIBLIOGRAPHY OF RESEARCH ON OCEAN FRONTS, 1984-1984 Final Report
L. B. GILHAM, J. J. MIKA, and D. A. WIESENBURG Aug. 1985 58 p
(AD-A160040; NORDA-TN-303) Avail: NTIS HC A04/MF A01 CSCL 08J

This report contains a bibliography of published papers describing research related to oceanic fronts. The citations cover research on physical, chemical and biological oceanographic studies of ocean fronts and also observations made by remote sensing. The papers listed cover the period from 1964 to 1984. A few earlier papers, considered classics, are also included. This bibliography was assembled as the first step in a program to study the dynamic chemical processes associated with ocean frontal boundaries. Over 750 citations are included. GRA

N86-17971# World Meteorological Organization, Geneva (Switzerland).
INTERNATIONAL LIST OF SELECTED, SUPPLEMENTARY AND AUXILIARY SHIPS
1985 403 p In ENGLISH and FRENCH
(WMO-47-ED-85) Avail: NTIS MF A01; hard copy available at WMO, Geneva, SWFR 37

The names, country of origin, instruments, operating conditions, number of radio operators, and call signs of ships in the World Meteorological Organization Observing Ship Scheme are listed. The method of obtaining sea surface temperature is indicated.
Author (ESA)

N86-17972# European Space Agency, Paris (France). PIPOR Science Working Group.
A PROGRAM FOR INTERNATIONAL POLAR OCEANS RESEARCH (PIPOR) Final Report
B. BATTRICK, ed. and E. ROLFE, ed. Sep. 1985 47 p refs
Original contains color illustrations
(ESA-SP-1074) Avail: NTIS HC A03/MF A01

The importance of polar regions in atmospheric and oceanic circulation is outlined, and a polar regions research program is proposed. Real-time, high resolution satellite data on ice distribution and characteristics are essential to a variety of application areas. Synthetic aperture radar data must be acquired over the entire polar region in a quantity sufficient to monitor significant geophysical processes. For optimal all-weather monitoring of the polar regions, satellite SAR data must be coupled with passive microwave data and augmented by measurements from in-situ, autonomous data-collection systems. Satellite observations must be validated through comparisons with measurements made by surface parties, airborne remote sensing, and submarines. Ocean buoy technology should be developed to provide expanded atmospheric and oceanic observations. High-quality hydrographic and geochemical measurements in the polar oceans will contribute significantly to understanding of ocean circulation. Modeling research in air - sea - ice interaction should be expanded.
Author (ESA)

N86-18028# Institute of Oceanographic Sciences, Wormley (England).
A STUDY OF ERS-1 RADAR ALTIMETER DATA PROCESSING REQUIREMENTS Final Report
T. H. GUYMER, D. J. T. CARTER, P. G. CHALLENOR, M. A. SROKOSZ (University College, London), A. R. TABOR (Centre National pour l'Exploitation des Oceans), C. G. RAPLEY, N. F. MCINTYRE (University College, London), R. F. SCOTT (University College, London), H. D. GRIFFITHS (University College, London), and P. QUEFFEULOU Paris ESA Jan. 1985 268 p refs
(Contract ESA-5681/83/NL-BI)
(ESA-CR(P)-2073) Avail: NTIS HC A12/MF A01

Data processing for the ERS-1 radar altimeter over oceans and sea ice for fast delivery products (near real time processing, onboard or at the ground station) and off line products is discussed. Useful products are identified and, the status of algorithms for extracting the relevent geophysical parameters from sensor data is reviewed. Suggestions concerning retrievals from ERS-1 data taking into account differences between ERS-1 and SEASAT are made. Problems concerning the extraction of wind speed, and the effects of sea surface nonlinearities are considered, and parameters, including a wave period, are proposed. Implications for the overall radar altimeter ground segment philosophy, including the accessibility and dissemination of products and standardization of formats are outlined.
Author (ESA)

N86-18352# Mullard Space Science Lab., Dorking (England).
A RADAR ALTIMETER AND THE VALIDATION OF ITS DATA PRODUCTS OVER ICE SURFACES
N. F. MCINTYRE, R. J. POWELL (Science Research Council, Chilton, England), and V. A. SQUIRE (Scott Polar Research Inst., Cambridge, England) *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 3-11 Jun. 1985 refs Sponsored by UK National Environment Council and UK Science and Engineering Research Council
Avail: NTIS HC A12/MF A01

A 13.81 GHz pulsed radar altimeter was flown on a Convair 990 during the Marginal Ice Zone Experiment in the Bering Sea and Greenland Sea. It was used in 10 different operating modes involving combinations of transmit/receive polarizations, nadir-pointing horn antennas and a steerable parabolic antenna. Averaging of returned pulses over nonuniform surfaces was studied in a program to validate altimeter data products over ice surfaces. Correlations of altimeter waveforms with helicopter photography indicate that algorithms for extracting concentration and other sea ice parameters are feasible. Coverage of previously surveyed profiles may also enable better characterization of ice sheet surfaces. The application of results is useful for geophysical interpretation of ERS-1's radar altimeter. Author (ESA)

N86-18370# Consiglio Nazionale delle Ricerche, Florence (Italy). Ist. di Ricerca sulle Onde Elettromagnetiche.
REMOTE SENSING OF OIL ON SEA: LIDAR AND PASSIVE IR EXPERIMENTS
F. CASTAGNOLI, G. CECCHI, L. PANTANI, I. PIPPI, B. RADICATI, C. SUSINI, P. MAZZINGHI, and A. BARBARO *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 121-126 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

A compact system for detecting and monitoring oil pollution on the sea from light aircraft using passive infrared remote sensing was developed. Lidar marine environment and pollution monitoring potential was assessed in the laboratory. The low-power airborne system is suitable for day and night operations in quite good weather. It performs a real time detection of the oil, a mapping of the spill, and an identification of its thickest parts. A suitable Lidar system can be composed by an XeCl excimer laser with small dimensions, a low energy consumption, and 50 mJ energy per pulse. The detection system does not require an optical multichannel analyzer, but it is possible to operate with only three interferential filters: one for Raman scattering signal, the others for fluorescence signals, which are sufficient to identify the oil class. Author (ESA)

N86-18371# Institut Francais du Petrole, Rueil-Malmaison. Div. de Teledetection Marine.
OPERATIONAL REMOTE SENSING OF OIL SLICKS AT SEA BY MICROWAVE RADIOMETRY
A. WADSWORTH and P. PIAU *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 127-130 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

Active microwave radiometry for oil spill thickness and volume estimation in the seas around France are reviewed. The technical solutions and the integration into an operational system are considered. Operating limits and development possibilities are discussed. Author (ESA)

N86-18372# Institut Francais du Petrole, Rueil-Malmaison.
SYNTHETIC APERTURE RADAR IMAGING OF THE SEA SURFACE DURING THE PROMESS EXPERIMENT
P. PIAU and L. GRAY (Canadian Center for Remote Sensing, Ottawa) *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 131-138 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

The PROMESS experiment carried out wind and wave measurements on the sea surface with radars operating in the C-band, as with the Active Microwave Instrument aboard ERS-1. A good range of wave heights (ranging from 1 to 7 m) and wind speeds were encountered. The SAR 580 performed measurements with different azimuth angles in C and X-bands simultaneously. Images were obtained from a digital processor and from an optical one. The two sets of images were processed with Fourier and speckle removal technics. The wave length and direction of the long waves is determined with good accuracy. One day featured two wave systems at the same time with different wave lengths and directions. The two systems are well separated and measured by the SAR. The shape of the equivalent monodirectional wave spectrum obtained is very close to the one measured by the waverider. Author (ESA)

N86-18386# Science Research Council, Chilton (England). Rutherford Appleton Lab.
RELATIVE VERTICAL POSITIONING USING GROUND-LEVEL TRANSPONDERS WITH THE ERS-1 ALTIMETER
R. J. POWELL *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 243-246 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

A technique for using the ERS-1 altimeter to measure the relative vertical position of land-based transponders and the ocean geoid on 2000 km long segments of the satellite ground track is proposed. The absolute position accuracy is similar to that of the laser tracking stations, relative accuracy may be of the order of a few centimeters, and measurements of changes in transponder elevation during the 3 yr satellite life may be at the sub-centimeter level. The opportunity for such measurements is provided by exploiting together very accurate range measurements made to ground-based transponders and the demonstrated constancy of form of satellite short-arc orbits repeated over an identical ground track. Altimetric vertical position measurements of this accuracy make possible techniques for altimeter calibration, sea-state bias measurements, orbit measurement and seismic/geodetic study. Author (ESA)

N86-18387# Mullard Space Science Lab., Dorking (England).
THE ERS-1 ALTIMETER TRACKER PERFORMANCE SIMULATION
C. G. RAPLEY, N. F. MCINTYRE, R. F. SCOTT, A. P. R. COOPER (Scott Polar Research Inst., Cambridge, England), E. NOVOTNY (Scott Polar Research Inst., Cambridge, England), A. R. BIRKS (Science Research Council, Chilton, England), and H. D. GRIFFITHS (Univ. Coll., London, England) *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 247-251 Jun. 1985 refs
(Contract ESA-5684/83/NL-BI)
Avail: NTIS HC A12/MF A01

An Altimeter Performance Simulator (APS) which permits the generation of simulated sequences of echo waveforms, and models the response of a radar altimeter tracker to them is presented. Results for the ERS-1 oceans mode tracking analytic waveforms representative of returns from the open ocean and sea ice, and its response to echo sequences synthesis are shown. Extensions of the APS include the addition of the ERS-1 ice tracking mode and the development of models representing coastal regions, land, and transitions from one surface type to another. Author (ESA)

N86-18939# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
ACTIVE AND PASSIVE REMOTE SENSING OF ICE Semiannual Progress Report, 1 Feb. - 31 Jul. 1985
J. A. KONG Jul. 1985 8 p
(Contract N00014-83-K-0258)
(AD-A160075) Avail: NTIS HC A02/MF A01 CSCL 08L

During this period we have: (1) developed a two-layer anisotropic random medium model to exploti the anisotropic effect of sea ice for active and passive microwave remote sensing, (2) used the Feynman diagrammatic technique in selectively summing and infinite perturbation series to include multiple scattering effects due to secularities that occur in the series for long-distance propagation, (3) extended the study of the two-layer anisotropic random medium model to a layer of isotropic random medium on top of a layer of anisotropic random medium in order to simulate the snow-covered ice fields for active microwave remote sensing, (4) used the strong fluctuation theory and the fluctuation-dissipation theorem to calculate the brightness temperature from a bounded layer of random discrete scatters with the zeroth and first order approximations, and (5) participated in the microwave sea ice measurement program at the Cold Regions Research and Engineering Laborataory (CRREL) in New Hampshire. Author (GRA)

N86-18940# Computer Genetics Corp., Wakefield, Mass.
RAMAN BACKSCATTERING TECHNIQUE FOR THE REMOTE MEASUREMENT OF SUBSURFACE TEMPERATURE AND SALINITY. VOLUME 1: REVIEW
B. CAPUTO and D. A. LEONARD Dec. 1984 29 p
(Contract N00014-81-C-0725)
(AD-A160095) Avail: NTIS HC A03/MF A01 CSCL 08J

This report describes the current status of research on the laser Raman technique for the remote sensing of subsurface ocean temperature and salinity. It summarizes the state of the art as it relates to current Navy requirements, showing what it can be used for now, and what further work is required to develop the technique to its full potential. Volume 1, this document provides a management summary of the research program carried out by the contractor. Ships, aircraft and satellites provide alternative and complimentary strategies for measuring the parameters of the marine environment. Subsurface temperature and salinity data obtained from ships and aircraft can be relatively comprehensive and accurate, but it is discrete and separated in time and space. The aim of the current research is to develop the capability to provide ships and aircraft with cost effective remote sensing instrumentation that can provide accurate and continuous subsurface temperature and salinity coverage. The spatial frequencies that would be available, on a quasi-synoptic basis (especially from aircraft), would significantly overlap with those available from satellite observations of the sea surface, thus enabling comparisons and allowing predictive statements to be developed. GRA

N86-18943# Naval Postgraduate School, Monterey, Calif.
OPTOMA (OCEAN PREDICTION THROUGH OBSERVATIONS, MODELING AND ANALYSIS) PROGRAM INTERIM REPORT: THE AIRBORNE OCEAN THERMAL STRUCTURE MAPPING PROJECT Report, for Feb. 1983 - Feb. 1985
M. C. COLTON and C. N. K. MOOERS Aug. 1985 106 p
(AD-A160283; NPS68-85-008) Avail: NTIS HC A06/MF A01 CSCL 08J

The Ocean Prediction Through Observation, Modeling and Analysis (OPTOMA) Program goals are to develop an ocean descriptive predictive system for studying and forecasting the evolution of ocean mesoscale features and the California Current System. Attainment of these goals requires the establishment of a broad-base ocean observing and monitoring system that includes, hydrographic research cruises, moored arrays, and remotely sensed data, etc. To forecast the evolution of the oceanic flow field, the observing system must include a means of obtaining real-time, synoptic maps for the initialization and verification of the dynamic model(s) used. P3 flights to deploy airborne expendable bathythermographs are a clear choice for frequent mappings. Since Feb., 1983 six OPTOMA missions have been flown. A total of 325 AXBTs have been successfully deployed off the northern and central California coasts. Data analysis reinforce recent discoveries about the character of the California Current System: the current regime is highly variable in nature and is comprised of cool anomalies, mesoscale eddies, 'squirts' and jets, current filaments and fronts. An airborne digital data acquisition system, built around an HP9816 microprocessor and a Sippican MK9 digitizing unit, digitizes the AXBT audio signal, then stores the profiles on diskette. GRA

N86-18945# Computer Genetics Corp., Wakefield, Mass.
REVIEW OF THE RAMAN BACKSCATTERING TECHNIQUE FOR THE REMOTE MEASUREMENT OF SUBSURFACE TEMPERATURE AND SALINITY: VOLUME 1 Summary Report
B. CAPUTO and D. A. LEONARD Dec. 1984 29 p
(Contract N00014-81-C-0725)
(AD-A160466) Avail: NTIS HC A03/MF A01 CSCL 17E

This document is a summary report which describes the current status of research on the laser Raman technique for the remote sensing of subsurface ocean temperature and salinity. The report, in three volumes, summarizes the state of the art as it relates to current Navy requirements, showing what it can be used for now, and what further work is required to develop the technique to its full potential. This document provides a management summary of the research program carried out by Computer Genetics Corporation over a number of years with support provided by several Government agencies including ONR, NRL, NASA and NOAA. The aim of current research is to develop the capability to provide ships and aircraft with cost effective remote sensing instrumentation that can provide accurate and continuous subsurface temperature and salinity coverage. The spatial frequencies that would be available, on a quasi-synoptic basis (especially from aircraft), would significantly overlap with those available from satellite observations of the sea surface, thus enabling comparisons and allowing predictive statements to be developed. The work to date has shown, by means of theoretical calculations, laboratory experiments, and field studies, that polarization Raman spectroscopy is feasible for the remote sensing of ocean temperature to a few tenths of a degree to depths of 50 to 100 meters in the open ocean. GRA

N86-18946# Naval Research Lab., Washington, D. C.
A SEMIEMPIRICAL MODEL FOR DOPPLER SPECTRAL FEATURES OF MICROWAVE RADAR SEA SCATTER Interim Report, Jun. - Oct. 1984
D. B. TRIZNA 16 Oct. 1985 32 p
(AD-A160576; NRL-8911) Avail: NTIS HC A03/MF A01 CSCL 17I

A semiempirical, fetch-dependent model is developed for Doppler spectral features of low grazing angle microwave radar sea scatter and is fit to data previously published in the literature. The model introduces this fetch dependence to account for the scatter in plots of the shift of the peak of the radar sea scatter Doppler spectrum data vs measured wind and surface parameters. First, constants for the model are determined by empirically curve fitting generalized versions of J. Darbyshire's fetch model equations to surface truth data (wind speed, wave height, and wave period), plotted in various combinations against one another, for 24 different experimental conditions. These constants are then applied to equations representing the Doppler shift of the peak of the sea scatter spectrum in terms of the surface truth data. Curves parametric in fetch, which are determined from these equations, are then superimposed over plots of the measured radar Doppler peak shifts vs the surface truth. It is found that these curves lie near the same groups of points in these plots of radar data vs surface truth, as the modified Darbyshire curves did for surface truth sets against one another. GRA

N86-19677# European Space Agency, Paris (France).
THE USE OF SATELLITE DATA IN CLIMATE MODELS
J. J. HUNT, comp. Sep. 1985 215 p refs Conference held in Alpbach, Austria, 10-12 Jun. 1985; sponsored by Austrian Solar and Space Agency, ESA, Bundesministerium fuer Forschung und Technologie, Commission of European Communities, European Science Foundation and World Climate Research Program
(ESA-SP-244; ISSN-0379-6566) Avail: NTIS HC A10/MF A01

The use of satellites for remote sensing of ocean waves, ocean circulation, sea level, sea ice, ice and snow and sea surface temperature, was discussed. The ESA ERS-1 program and its national data centers were described.

N86-19679# Massachusetts Inst. of Tech., Cambridge.
IMPACT OF SATELLITE MEASUREMENTS ON OCEANOGRAPHIC COMPONENT OF THE WCRP
C. WUNSCH *In* ESA The Use of Satellite Data in Climate Models p 3-6 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

The use of satellite scatterometry, altimetry, gravity, and IR/microwave thermometry data in oceanography is discussed. The satellite needs of the Tropical Ocean-Global Atmosphere program and the World Ocean Circulation Experiment are reviewed. Accuracy, precision, sampling, and coverage requirements on satellite systems are considered. Author (ESA)

N86-19680# Royal Netherlands Meteorological Inst., De Bilt.
INTRODUCTION TO WAVE MODELS AND ASSIMILATION OF SATELLITE DATA IN WAVE MODELS
G. J. KOMEN *In* ESA The Use of Satellite Data in Climate Models p 21-25 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

Knowledge of the development of wind driven ocean waves, and wave models are discussed. The models integrate the energy transfer equations for the two dimensional wave spectrum numerically in time. The solution depends on external wind fields, specified in advance. Main applications are for ship routing, off-shore activities, and coastal defense. Validation of real-time model forecast results indicates the need for improvement of model results and wind input. Very little experience exists with the assimilation of wave observations into initial fields. A hindcast indicates that the effects of inaccuracies in the specified wind fields can be compensated by assimilation of observed wave parameters. Author (ESA)

N86-19681# Meteorological Office, Bracknell (England).
ALGORITHMS FOR WIND SCATTEROMETER PROCESSING
D. OFFILER *In* ESA The Use of Satellite Data in Climate Models p 27-31 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

The measurement of surface wind speed and direction over the ocean, using scatterometry is introduced. The theoretical and experimental background to the technique and how this translates into practical instruments is outlined. The algorithms used to retrieve the wind vectors are described. Algorithms for the ERS-1 mission are broadly similar to those previously used for the SEASAT SASS instrument. Author (ESA)

N86-19682# Hochschule der Bundeswehr, Munich (West Germany).
ALGORITHM FOR WIND SCATTEROMETER DATA ANALYSIS-AMBIGUITY SUPPRESSION
K. J. SCHWENZFEGER *In* ESA The Use of Satellite Data in Climate Models p 35-36 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

An algorithm for retrieving the wind vectors of the bias corrected backscatter coefficients derived from simulated ERS-1 wind scatterometer measurements is described. The main task is wind vector estimation by fitting the beam ordered sigma zeros onto the ESA C-band model using a Bayesian type estimator (BE). Extremizing BE gives up to four wind vectors for each cell of the swath. The goodness of fit gives a ranking of solutions. The results of case studies show that nearly 100% of the rank 1 solutions are the correct wind vectors, so no additional postprocessing is necessary. Author (ESA)

N86-19683# Bremen Univ., (West Germany). Fachbereich 1.
MICROWAVE MEASUREMENTS OF THE SEA SURFACE
W. ALPERS *In* ESA The Use of Satellite Data in Climate Models p 41-45 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

Interpretation of ERS-1 Active Microwave Instrument (AMI) data in terms of oceanographic parameters is discussed. In order to extract quantitative information from the SAR image, the C-band modulation transfer function (MTF) was calculated, using data from a modulation experiment in the North Sea. Imaging of large scale oceanic features is considered. Author (ESA)

N86-19684# Max-Planck-Inst. fuer Meteorologie, Hamburg (West Germany).
ASSIMILATION OF MICROWAVE DATA IN ATMOSPHERIC AND WAVE MODELS
K. HASSELMANN *In* ESA The Use of Satellite Data in Climate Models p 47-52 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

Use of ERS-1, N-ROSS, TOPEX, and MOS-2 satellite data on global sea surface topography, surface winds, ocean waves, and sea ice for climate research and weather and wave forecasting is discussed. The need for an end-to-end data processing and assimilation system, including algorithms, dynamic data assimilation methods, and high resolution models, in order to produce the basic global data sets required for climate research is considered. It is shown that the data processing needs for climate studies are essentially the same as the processing needs for forecasting applications, so that the same system can satisfy both purposes. The relation of this end-to-end system, designed for the quasi-real time generation of level 3 gridded wind and wave fields, with other components of the ground segment, such as the generation of fast delivery products or the primary archiving facilities, is treated. Author (ESA)

N86-19685# Kiel Univ. (West Germany).
INTRODUCTION TO OCEAN CIRCULATION MODELS
J. WILLEBRAND *In* ESA The Use of Satellite Data in Climate Models p 63-64 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

Prognostic and diagnostic ocean models are reviewed, and their equations of motion, including primitive equation and geostrophic models are discussed. Circulation models can reproduce the wind-driven subtropical gyres, and the equatorial circulation system including its variations on time scales up to a few years. The effect of quasi-geostrophic eddies is fairly well simulated. On longer time scales, the situation is less satisfactory with respect to thermohaline processes. It seems likely that the situation will improve by 1990 when several satellites are expected to be in operation. A considerable effort, however, is needed for the development of circulation models that can assimilate wind and altimeter data on a global basis. Author (ESA)

N86-19686# Meteorological Office, Bracknell (England). Dynamical Climatology Branch.
COMMENTS ON DATA REQUIREMENTS FOR OCEAN CLIMATE STUDIES
H. CATTLE *In* ESA The Use of Satellite Data in Climate Models p 67-69 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

The requirements for carrying out noninteractive integrations of ocean (and sea ice) models are discussed. Such integrations require forcing data to be specified from a knowledge of atmospheric parameters and the sea surface temperature and ice characteristics. In such integrations, the momentum flux is often specified directly via the vector surface stress fields (expressed in the main as monthly means. To determine the heat exchange across the interface, it is appropriate to specify the incoming radiative fluxes together with the air temperature, humidity, wind speed, and surface pressure from which the outgoing radiative fluxes and turbulent, sensible, and latent heat exchanges can be derived using the model predicted sea surface temperature and sea ice characteristics. The use of scatterometers and satellites, particularly for data-sparse areas of the Southern Hemisphere is discussed. Author (ESA)

N86-19687# Paris VI Univ. (France). Lab. de Physique et Chimie de l'Hydrosphere.
ANALYSIS AND INTERPRETATION OF ALTIMETRY DATA
J. F. MINSTER *In* ESA The Use of Satellite Data in Climate Models p 71-72 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

Ways to extract the variability signal on the mesoscale and large scale from satellite altimetry studies of ocean dynamics are reviewed. Methods include comparison of the variability of signals along a repetitive track with the dynamic topography of the area; analysis of the residuals of the altimetric measurement at crossovers of ascending and descending tracks, after adjustment of the latter to minimize orbit errors; and use of the distance of individual track measurements to a reference mean sea surface. By using a large set of short crossover-adjusted arcs, it is possible to map larger than mesoscale variability. Author (ESA)

N86-19688# Imperial Coll. of Science and Technology, London (England). Atmospheric Physics Group.
ALTIMETRIC OBSERVING SYSTEM SIMULATION STUDIES WITH AN EDDY RESOLVING OCEAN CIRCULATION MODEL
J. MARSHALL *In* ESA The Use of Satellite Data in Climate Models p 73-76 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

Synoptic mapping of geostrophic eddies from altimetry by assimilation into a quasi-geostrophic ocean model is discussed. It is shown that for synoptic mapping the accuracy of the analysis is limited by the finite temporal and spatial resolution possible with one satellite, rather than the random error in the instrument. There is a clear advantage in flying several moderately accurate altimeters rather than one very precise instrument. The importance of ensuring that altimetric missions are synchronized so that more than one altimeter is flying simultaneously is stressed. Author (ESA)

N86-19689# Utrecht State Univ. (Netherlands). Inst. of Meteorology and Oceanography.
SEA LEVEL AND CLIMATE VARIATIONS
J. OERLEMANS *In* ESA The Use of Satellite Data in Climate Models p 81-85 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

Factors governing sea level and the relation between sea level and carbon dioxide are reviewed. The use of satellite data to study global variations in sea level is discussed. The greenhouse effect on the polar ice sheets, and consequences for sea level, are assessed. It is concluded that data are insufficient to make predictions other than that global temperature will increase. Author (ESA)

N86-19690# Max-Planck-Inst. fuer Meteorologie, Hamburg (West Germany).
SEA ICE MODELS AND REMOTE SENSING
W. D. HIBLER *In* ESA The Use of Satellite Data in Climate Models p 87-94 Sep. 1985 refs Sponsored by Office of Naval Research and Max-Planck Institute fuer Meteorologie, Hamburg
Avail: NTIS HC A10/MF A01

Sea ice modeling and how satellite remote sensing can be used in model verification, improvement, and applications are discussed. Ice dynamics, including the relevance of ice drift and deformation to climate are considered. The role and justification for the use of nonlinear plastic rheologies is described. In order to show the necessity for ice-ice interaction in coupled dynamic-thermodynamic simulations, seasonal Arctic simulation results using only free drift are compared to those using a plastic rheology. Results without ice interaction yield a totally unacceptable ice build-up, even after only a 1 yr integration. Ice edge variation and coupled ice ocean models are mentioned. Author (ESA)

N86-19691# Institute of Oceanographic Sciences, Birkenhead (England).
ACCURACY OF EXISTING OCEAN TIDE MODELS
P. L. WOODWORTH *In* ESA The Use of Satellite Data in Climate Models p 95-98 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

The Schwiderski (1983) and Parke-Hendershott (1980) ocean tide models are assessed. The Schwiderski model is claimed to be capable of computing the instantaneous M2 partial ocean tide with an accuracy of 5cm or better at any time and anywhere in the open ocean although with certain reservations for coastal and border seas. Pelagic data show this claim to be optimistic. Similar model claims are made for the other tidal constituents resulting in a predicted combined tide accuracy of 10cm. Until copious altimeter data become available there is no real way, other than by additional tide gage measurements, of checking them. The Parke-Hendershott model is of comparable accuracy and is subject to similar difficulties of validation on a global basis. Author (ESA)

N86-19692# Technical Univ. of Denmark, Lyngby.
APPLICATION OF SAR AND OTHER REMOTE SENSING DATA IN STUDIES OF THE ATMOSPHERE-OCEAN-ICE INTERACTION
P. GUDMANDSEN *In* ESA The Use of Satellite Data in Climate Models p 107-111 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

The physics of the atmosphere-ocean-ice interaction, the processes of the formation of sea ice and its characteristics from a remote sensing point of view, and the relevant remote sensing methods are reviewed. Use of the ERS-1 Active Microwave Instrument in the Arctic and Antarctic is discussed. The need for preparatory observation and modeling research to fully exploit satellite capabilities is stressed. Author (ESA)

N86-19693# National Museum of Natural History, Paris (France). Lab. d'Oceanographic Physique.
SCIENTIFIC APPLICATION OF SAR DATA TO SEA ICE STUDIES. SEA ICE MODELS
J. C. GASCARD *In* ESA The Use of Satellite Data in Climate Models p 113-114 Sep. 1985
Avail: NTIS HC A10/MF A01

Sea ice observations from space are discussed and SAR contributions to sea ice numerical modeling are assessed. Satellite observations of sea ice concentrations in two dimensions help considerably in tuning models for a better prediction of ice thickness and for sea ice mass balance estimations. Author (ESA)

N86-19694# Atmospheric Environment Service, Ottawa (Ontario).
SCIENTIFIC APPLICATION OF PASSIVE MICROWAVE SATELLITE DATA FOR ICE MONITORING AND RESEARCH
I. G. RUBINSTEIN (Ph.D. Associates, North York, Ontario) and R. O. RAMSEIER *In* ESA The Use of Satellite Data in Climate Models p 117-123 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

Algorithms for determination of total sea ice concentrations and ice type identification were tested during near real-time operational production of sea ice charts for the Arctic, Canadian East Coast, and the East Greenland Sea regions. Using computer contouring techniques, the sea ice parameters were determined with a spatial location accuracy within one half of a 37 GHz footprint (15 km). Model calculated total ice concentrations are in close agreement with values measured by the airborne sensors (10% deviation). In areas where gray and very young ice are present, the total ice concentrations are underestimated by 50%. The near real-time operational testing of the algorithm derived ice and wind charts provides very valuable information for improvement of the existing sea ice algorithms. The all weather capabilities of the spaceborne passive microwave sensors are positively established. Author (ESA)

N86-19695# Science Research Council, Chilton (England). Rutherford Appleton Lab.
FUTURE PASSIVE MICROWAVE SATELLITE DATA FOR SEA-ICE RESEARCH
D. L. CROOM *In* ESA The Use of Satellite Data in Climate Models p 125-127 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

The potential of the passive microwave radiometers which form part of the Along Track Scanning Radiometer (ATSR) to be flown on ERS-1, and the Advanced Microwave Sounding Unit (AMSU) to be flown on the NOAA-TIROS series, for studies of sea-ice is surveyed. The ATSR will carry limited, but useful passive microwave channels for sea-ice studies, especially for assessing the value of altimetry over sea-ice. The AMSU-B will be a source of extensive sea-ice data and will provide it over a long (20yr plus) time scale. The AMSU-B should also be considered as a potential valuable source of data for land snow-cover. Author (ESA)

N86-19696# Science Research Council, Chilton (England). Rutherford Appleton Lab.
PRECISE SST DATA FROM SATELLITES
D. T. LLEWELLYN-JONES *In* ESA The Use of Satellite Data in Climate Models p 139-142 Sep. 1985
Avail: NTIS HC A10/MF A01

The importance of ocean skin tempratures, in contrast to bulk temperatures, in climate models using sea surface temperatures measured by the ERS-1 Along Track Scanning Radiometer (ATSR) is pointed out. The ATSR accuracy is expected to reach 0.3 K, i.e., a factor of 2 better than AVHRR, and modellers who require bulk temperatures should say so, as this affects data products and their treatment. Author (ESA)

N86-19699# Istituto di Fisica dell Atmosfera, Rome (Italy).
REMOTE SENSING OF SEA SURFACE TEMPERATURE
G. DALU and A. VIOLA *In* ESA The Use of Satellite Data in Climate Models p 143-145 Sep. 1985 refs Sponsored by CNR
Avail: NTIS HC A10/MF A01

The methodology that lies behind the algorithms used to retrieve the sea surface temperature from infrared radiometric data is examined with a radiative transfer model, that simulates the response of the atmosphere for different temperature and water vapor profiles. Generally linear algorithms are used to evaluate the sea surface temperature from the AVHRR data. Although the results obtained show that a nonlinear algorithm is more accurate, a linear algorithm can give better results if it is optimized for a particular region and season. Results show that the algorithms found in the literature are appropriate to particular data sets, and no single algorithm can be applied to other samples if they are from a completely different area or a different season.
Author (ESA)

N86-19700# Mullard Space Science Lab., Dorking (England).
POST LAUNCH CALIBRATION AND VALIDATION OF THE ALONG TRACK SCANNING RADIOMETER (ATSR)
I. M. MASON *In* ESA The Use of Satellite Data in Climate Models p 149-150 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

On-board calibration and validation of the ERS-1 Along Track Scanning Radiometer (ATSR), used for sea surface temperature (SST) measurement, are discussed. It is important that on-board calibration and validation are carried out to a precision compatible with the lowest expected atmospheric noise (0.1K RMS). The skin SST should ideally be the validated ATSR product, for reasons of accuracy and because of the role of skin SST in the ocean/atmosphere heat exchange. If possible, each algorithm should be validated separately, using a variety of instruments and sites. To retain the ATSR levels of precision, any correction of algorithms using validation data should be done by modeling the physical processes giving rise to the algorithm errors. An improved understanding and modeling of the skin/bulk SST differences will allow the validation of ATSR using bulk SST and aid the incorporation of ATSR data in climate models. Author (ESA)

N86-19701# Oxford Univ. (England). Dept. of Atmospheric Physics.
FOUR-DIMENSIONAL DATA ASSIMILATION IN TOGA MODELS
D. L. T. ANDERSON and A. M. MOORE *In* ESA The Use of Satellite Data in Climate Models p 151-153 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

Use of ocean surface stress and heat fluxes in Tropical Ocean Global Atmosphere program models is discussed. Since the forcing fields are perfectly known and the ocean is not totally deterministic, redundancy must be built in. Measurements give mass field information, and numerical models indicate that this data may be very useful. The models do not reject height field data. Altimeter data could be very useful for interpolating between tide gage networks. Altimeter data can also be assimilated into models. The best method of projecting this data onto the vertical model structure uses XBT data. Sea surface temperatures (SST) used with XBT data may be very useful. Altimetry and SST can be used for model verification even if they are not used for assimilation.
Author (ESA)

N86-19702# Science Research Council, Chilton (England). Rutherford Appleton Lab.
THE USE OF AIRBORNE MICROWAVE INSTRUMENTS TO GATHER DATA FOR THE VALIDATION OF ERS-1 WIND AND WAVE PRODUCTS
R. J. POWELL *In* ESA The Use of Satellite Data in Climate Models p 155-156 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

It is suggested that the main European effort to validate the wind and wave data products of ERS-1 should be concentrated in the Northeast Atlantic and Norwegian Sea. Conventional oceanographic data gathering techniques using ships and buoys should be augmented with permanently deployed and well-validated master stations and airborne instrumentation. The need to site such stations and altimeter transponders on the ground track argues strongly for the early selection of the location of 3 day repeat ground tracks and for ensuring that any higher repeat cycle used later is a multiple of 3. Author (ESA)

N86-19703# Institute of Oceanographic Sciences, Wormley (England).
WINDS FOR CLIMATE RESEARCH FROM THE ERS-1 AND N-ROSS SCATTEROMETERS
T. H. GUYMER *In* ESA The Use of Satellite Data in Climate Models p 157-159 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

Requirements for sea-surface wind in climate research are discussed in terms of accuracy and sampling considerations. Very stringent accuracies are needed and it is particularly important that biases in areal and temporal mean winds be minimized. These may arise from geographical biases in algorithms tuned to limited comparison data sets and from atmospheric attenuation effects. A single satellite scatterometer is incapable of providing adequate sampling and it is envisaged that the surface wind fields will be obtained from a combination of ERS-1, N-ROSS and in-situ data, including those of the Voluntary Observing Ships. Author (ESA)

N86-19704# European Space Agency, Paris (France).
REVIEW OF SCIENTIFIC AND TECHNICAL WORK REQUIRED BEFORE THE LAUNCH OF ERS-1: THE VIEW OF ESA
G. DUCHOSSOIS, J. LOUET (ESA/ESTEC, Noordwijk, Netherlands), C. R. FRANCIS (ESA/ESTEC, Noordwijk, Netherlands), and E. ATTEMA (ESA/ESTEC, Noordwijk, Netherlands) *In its* The Use of Satellite Data in Climate Models p 163-173 Sep. 1985
Avail: NTIS HC A10/MF A01

The ESA views and plans for the utilization of ERS-1 data, sensor calibration and data validation, and activities for the coordination/cooperation with entities interested in ERS-1 and/or having similar programs under preparation are summarized. The ERS-1 will study coastal zones and global ocean processes which, together with the monitoring of polar regions, will provide a major contribution to the World Climate Research Program. It will establish, dovelop, and exploit coastal, ocean, and ice applications of remote sensing data. These applications are related mainly to a better knowledge of ocean and ice parameters and sea-state conditions. The Active Microwave Instrument and radar altimeter are presented.
Author (ESA)

N86-19706# Mullard Space Science Lab., Dorking (England).
THE UK ERS DATA CENTRE
C. G. RAPLEY *In* ESA The Use of Satellite Data in Climate Models p 177-179 Sep. 1985
Avail: NTIS HC A10/MF A01

The data facility to be built by the UK as part of its ERS-1 program and a measure taken within that facility to alleviate the problem of inadequate access to hardware and data sets are described. The main functions of the center are data receipt and archive; algorithm development; off-line product generation; product validation/quality monitoring; customer services; and dispatch.
Author (ESA)

N86-19707# Centre National d'Etudes Spatiales, Paris (France). Earth Sciences and Applications Div.
THE CERSAT/AVISO/ALGOS: THE FRENCH PROGRAM FOR A COHERENT OCEANOGRAPHIC DATA BASE
B. NUTTEN *In* ESA The Use of Satellite Data in Climate Models p 181-183 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

The French national plan for data handling of ERS-1 and future space oceanographic missions is presented. It is based on two data centers and one group. The CERSAT is the ERS-1 off-line low bit rate data center, part of the four-component preprocessing and archiving facilities managed by the Earthnet Program Office, aimed at production of geophysical data. The AVISO is a multisatellite data center for archiving geophysical oceanographic data, and processing of value-added products. The purpose of the ALGOS group, coordinated by scientists and engineers, is the development of models and algorithms required by the Data Centers. Author (ESA)

N86-19812# Science Applications International Corp., La Jolla, Calif.
INTEGRATED REPORT ON MECHANISMS RESPONSIBLE FOR NARROW ANGLE V-WAKES IN THE GEORGIA STRAIT EXPERIMENT Final Report
E. D. BROWN Jun. 1985 30 p
(Contract N00014-83-C-0438)
(AD-A159892) Avail: NTIS HC A03/MF A01 CSCL 20D

The Georgia Strait Experiment was designed to identify the mechanisms responsible for SAR imaging of narrow angle v-wakes. SAR overflights were coordinated with surface measurements of environmental conditions and of wave height and slope within a ship wake. Narrow v-wakes were observed by and L-band aircraft SAR with incidence angles of 20 - 50 deg, under low ambient wind conditions for all relative orientations between the SAR and ship tracks. These V-lines are a few pixels wide (approx 10 m), several kilometers in length, and approx. 17 dB above the background radar backscatter at a distance of 1 km behind the ship. Surface measurements and modeling analysis from this experiment demonstrate that these v-wakes are unrelated to ship-generated internal wave wakes. The qualitative features of L-band v-wakes are consistent with first order Bragg scattering from intermittently generated ship surface waves. This report reviews the theoretical basis and the experimental evidence supporting this mechanism. GRA

N86-19814# Naval Polar Oceanography Center, Washington, D.C.
ANTARCTIC ICE CHARTS, 1983-1984
Sep. 1985 215 p
(AD-A159907; RR-6) Avail: NTIS HC A10/MF A01 CSCL 08L

This publication is the sixth in a continuing bi-yearly series of Antarctic sea ice atlases prepared in the Joint Ice Center at the Naval Polar Oceanography Center, Suitland. The Atlas contains weekly charts depicting Southern Hemisphere ice conditions and extents. The information presented was prepared under operational time constraints principally from satellite imagery supplemented by conventional observations. Table 1, located on the inside back cover, summarizes satellite data availability for 1983 and 1984. GRA

N86-19822# Naval Postgraduate School, Monterey, Calif.
DETECTION OF SHOALS IN SEASAT SYNTHETIC APERTURE RADAR IMAGERY: SELECTED CASE STUDIES M.S. Thesis
R. L. DICKERMAN Sep. 1985 142 p
(AD-A161181) Avail: NTIS HC A07/MF A01 CSCL 08J

Ocean-going vessels have increased in size and draft in recent years, making traditional waterways too shallow and dangerous for use, and new shipping methods and increased costs require shorter transit times. Therefore, as new shipping routes are being sought, limited hydrographic survey resources must be efficiently applied. This study sought to demonstrate the feasibility of synthetic aperture radar (SAR) imagery as a tool for hydrographic presurvey planning by analyzing SAR imagery of Shelikof Strait, Alaska. Anomalous brightness patterns visible in SAR imagery were related to interactions between ocean phenomena and bathymetric features, and an analysis of wave refraction was performed using optical Fourier transform (OFT)-measured wave spectra. The study results showed surface gravity wave refraction as measured by OFT's can be used to make quantitative estimates of water depths, generally within 40% error. Also, anomalous brightness patterns visible in SAR imagery indicate possible hazards to navigation. However, the absence of an anomalous pattern does not mean a hazard is not present. Author (GRA)

N86-20261# Joint Publications Research Service, Arlington, Va.
AEROSPACE OBSERVATIONS OF ADVECTIVE-EDDY FORMATIONS IN CENTRAL BALTIC SEA Abstract Only
I. A. BYCHKOVA, S. V. VIKTOROV, V. V. VINOGRADOV, V. N. LOSINSKIY, and K. Y. BROSIN *In its* USSR Report: Space (JPRS-USP-86-001) p 156 13 Jan. 1986 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 1, Jan. - Feb. 1985 p 118-122 Original language document was announced in IAA as A85-29915
Avail: NTIS HC A03

Under definite conditions eddy movements occurring at different depths in the Baltic Sea can be manifested in the form of surface nonuniformities of the temperature field and brightness of the sea surface. These nonuniformities are registered by satellite instruments operating in the visible and IR ranges. Considering the role of the wind in dynamic processes in the Baltic, there is probably a high frequency of recurrence of formation of local advective-eddy fronts of synoptic scales in the surface layer. Study of such phenomena was the objective of the second USSR-GDR Complex Subsatellite Experiment. The research ship A. von Humboldt during the first half of June 1983 was in a hydrological test range in the central part of the sea, each day occupying 8 to 9 stations. Satellite information in the IR range was received simultaneously. The observations revealed that regardless of wind conditions a correlation between radiation temperatures obtained from both a satellite and aircraft and shipboard thermodynamic temperatures can be traced to a depth of 17 m. At a depth of 35 to 40 m the correlation coefficient becomes negative, corresponding to the formation of a countercurrent in the Ekman layer. Accordingly, sea surface temperature maps obtained in the Baltic Sea using satellite data can be used in tracking drift currents. The three-dimensional thermal structure in the test range for 7 June on the basis satellite and ship is discussed. Author

N86-20267# Joint Publications Research Service, Arlington, Va.
POSSIBILITY OF USING SATELLITE IR-INFORMATION FOR OCEANOLOGICAL RESEARCH Abstract Only
I. V. LIKHACHEV and A. N. MICHURIN *In its* USSR Report: Space (JPRS-USP-86-001) p 160-161 13 Jan. 1986 Transl. into ENGLISH from Vestnik Leningradskogo Universiteta: Geologiya, Geografiya (Leningrad, USSR), no. 14, issue 2, Jun. 1985 p 93-95
Avail: NTIS HC A03

Although there are real possibilities for obtaining satellite information (SI) for considerable expanses of the ocean, there are still no possibilities for its routine processing. This dictates a need for storing SI for its subsequent processing at on-shore computation centers. In exploring this problem, a Kapsi receiving station was used in determining the possibility of reception and registry of SI on an intermediate magnetic carrier with subsequent input of the SI into a computer. It was found that an ordinary magnetic recorder tape can be used as a magnetic carrier. An effective method was developed for SI registry on magnetic tape. On one track of an ordinary stereophonic recorder having adequately high frequency characteristics and relatively low detonation, there is registry of a satellite signal of a subcarrier frequency from the receiver output; the second track is used in registering a pulsed signal from a highly stable quartz oscillator used in data processing as a synchronizable signal determining the discreteness of SI digital readings. The next stage in data preparation is the input of satellite data registered on magnetic tape into a computer memory, with discrimination of R-radiometer data from the total volume of data. R.J.F.

N86-20449# Joint Publications Research Service, Arlington, Va.
OPTICAL THICKNESS OF ATMOSPHERIC AEROSOL OVER SEA Abstract Only
K. S. SHIFRIN, V. M. VOLGIN, B. N. VOLKOV, O. A. YERSHOV, and A. V. SMIRNOV *In its* USSR Report: Space (JPRS-USP-86-002) p 65 10 Feb. 1986 Transl. into ENGLISH from Issledovaniye Zemli Iz Kosmosa (Moscow, USSR), no. 4, Jul. - Aug. 1985 p 21-30 Original language document was announced in IAA as A86-13276
Avail: NTIS HC A05

Measurements of the optical depth of the atmospheric aerosol over marine and coastal regions are presented. The measurements were carried out using a photoelectric amplifier and a photodiode detector having a combined sensitivity in the range 300-1016 nm. The measured data were cross correlated using the Burder method and the results are discussed. It is shown that the two sets of measurements have good correlation in the visible band (300-500 nm), and in the infrared (500-1016 nm). The estimated optical depths are given in a table. I.H.

N86-20678*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DEVELOPMENT OF UHF RADIOMETER
B. M. KENDALL, H. J. C. BLUME, and A. E. CROSS Dec. 1985 58 p refs
(NASA-TP-2504; L-16006; NAS 1.60:2504) Avail: NTIS HC A04/MF A01 CSCL 09A

A wideband multifrequency UHF radiometer was initially developed to operate in the 500 to 710 MHz frequency range for the remote measurement of ocean water salinity. However, radio-frequency interference required a reconfiguration to operate in the single-frequency radio astronomy band of 608 to 614 MHz. Details of the radiometer development and testing are described. Flight testing over variable terrain provided a performance comparison of the UHF radiometer with an L-band radiometer for remote sensing of geophysical parameters. Although theoretically more sensitive, the UHF radiometer was found to be less desirable in practice than the L-band radiometer. Author

N86-21096# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatial.
STUDY OF THE APPLICATIONS OF ALTIMETRY DATA AND EXTRACTION METHODS Final Report [ETUDE SUR LES APPLICATIONS DES DONNEES D'ALTIMETRIE ET METHODES D'EXTRACTION]
A. DELEFFE, M. AVIGNON, P. RAIZONVILLE, G. CUVELIER, and Y. MENARD (Groupe de Recherches de Geodesie Spaciale, GRGS, Toulouse, France) 29 Jan. 1985 426 p refs In FRENCH
(Contract ESA-5812/84/NL-PB(SC))
(ESA-CR(P)-2113) Avail: NTIS HC A19/MF A01

The characteristics and utility of possible oceanographic and geophysics products are examined, refering to SEASAT results and to ERS-1 satellite possibilities. A global analysis of altimetric measurement errors is presented, estimating the amplitude and associated wavelength of the errors before and after correction. The main sources of error include instrument errors, for which a simulation computer program was developed in order to obtain quantitative estimations, errors due to ocean surface-electromagnetic interaction, propagation errors, and errors due to geophysical factors such as tides and atmospheric pressure. The algorithms used for SEASAT were studied, leading to data processing propositions for ERS-1. An external calibration strategy, using the laser site at Dakar, is also presented. Author (ESA)

N86-22024*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ASSESSING THE CAPABILITY OF EOS SENSORS IN MEASURING OCEAN-ATMOSPHERE MOISTURE EXCHANGE
W. T. LIU 15 Dec. 1985 26 p refs
(Contract NAS7-918)
(NASA-CR-176658; JPL-PUB-85-93; NAS 1.26:176658) Avail: NTIS HC A03/MF A01 CSCL 04A

As part of the Science Synergism Studies to identify interdisciplinary Scientific studies, which could be addressed by the Environmental Observing System (EOS), the techniques being developed to measure ocean-atmosphere moisture exchanges using satellite sensors were evaluated. Studies required to use sensors proposed for EOS were examined. A method has been developed to compute the moisture flux using the wind speed, sea surface temperature, and preciptable water measured by satellite sensors. It relies on a statistical model which predicts surface-level humidity from precipitable water. The Scanning Multichannel Microwave Radiometer (SMMR) measures all 3 parameters and was found to be sensitive to the annual cycle and large interannual variations such as the 1982 to 1983 El Nino. There are systematic differences between geophysical parameters measured by Nimbus/SMMR and in situ measurements. After quadratic trends and crosstalks were removed from the parameters through multivariate regressions, the latent heat fluxes computed from SMMR agree with those computed from ship reports to within 30 W/sq m. The poor quality of ship reports may be the cause of a portion of this scatter. Similar results are found using SEASAT/SMMR data. When the scatterometer winds were used instead of the SMMR winds, the difference between the satellite fluxes and the ship fluxes was reduced. Author

N86-22075# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
CZCS (COASTAL ZONE COLOR SCANNER) ATLAS OF WATER OPTICAL PROPERTIES IN THE ALBORAN SEA Final Report
R. ARNONE and R. ORIOL Aug. 1985 28 p
(AD-A162503; NORDA-117) Avail: NTIS HC A03/MF A01 CSCL 08J

Optical water properties of the world oceans can be rapidly obtained from data from the Coastal Zone Color Scanner (CZCS) aboard the Nimbus -7 satellite. Satellite processing techniques have been developed to eliminate the atmospheric contamination that contributes 90% of the total visible channel signal. The remaining signal, which constituted the ocean color, is directly related to the diffuse attenuation coefficient (k) at 490 nanometers for the upper surface waters. Calculation and geographic registration of k can be done for each of the 800-square-meter pixel resolution of CZCS, and results show that the accuracy is within 25% of ship measurements. This report indicates the processing procedures used to calculate k from radiance data from the CZCS. GRA

06

HYDROLOGY AND WATER MANAGEMENT

Includes snow cover and water runoff in rivers and glaciers, saline intrusion, drainage analysis, geomorphology of river basins, land uses, and estuarine studies.

A86-19501
SATELLITE-BASED ESTIMATORS OF HEAVY PRECIPITATION
R. A. SCOFIELD (NOAA, Satellite Applications Laboratory, Washington, DC) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 84-91. refs

The purpose of this paper is to present satellite-GOES based methodologies for analyzing and forecasting (short range) precipitation from convective systems, extratropical cyclones and tropical cyclones. Currently, satellite-derived precipitation estimates and 3-hour precipitation trends for convective systems, extratropical cyclones and tropical cyclones are computed on the NESDIS Interactive Flash Flood Analyzer and transmitted via AFOS to Weather Service Forecast Offices, Weather Service Offices and River Forecast Centers. These estimates and trends aid hydrologists and meteorologists in their evaluation of heavy precipitation events. Author

A86-21152#

WATER QUALITY MONITORING OF LAKE BALATON USING LANDSAT MSS DATA

H. SHIMODA, M. ETAYA, T. SAKATA (Tokai University, Tokyo, Japan), L. GODA, and K. STELCZER (Vizgazdalkodasi Tudomanyos Kutatokozpont, Budapest, Hungary) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 565-574.

Water quality monitoring of Lake Balaton, Hungary was studied using Landsat MSS data. Ground truth measurements were done simultaneously with the data acquisition of MSS data and fourteen items of water qualities were measured on the lake. After certain preprocessing of MSS data, linear multi regression analyses were made between MSS data and ground truth data. Nine items among the water qualities showed correlations to the MSS data, especially transparency, chlorophyll-a, UV extinction and oxygen saturation showed sufficient and strong correlations. These four kinds of water quality patterns were clearly extracted. Author

A86-21174#

SURFACE CURRENTS IN THE LONG POINT REGION AS DETERMINED FROM LANDSAT IMAGERY

E. F. LEDREW and S. E. FRANKLIN (Waterloo, University, Canada) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 885-894. Research supported by the Board of Industrial Leadership and Development. refs
(Contract NSERC-A-8454)

The surface currents of the Long Point region of Lake Erie have been mapped from Landsat imagery for eight cases. Current patterns are inferred from the configuration of sediment tendrils observed on enhanced and classified images. A 'coastal jet' is clearly evident along the south shore of Long Point for all weather patterns; when the intensity is not reduced by a north component in the regional air flow, an instability vortex develops to the east of the tip of Long Point. Within the Long Point Bay, a counterclockwise flow is observed that appears to be part of a gyre. Effluents released within this region could possibly become part of a closed circulation so the implications for the sensitive marshes of Turkey Point and Long Point must be considered. D.H.

A86-21195#

APPLICATION OF MULTISENSOR OBSERVATIONS TO GREAT LAKES HYDROLOGIC FORECAST MODELS

R. L. GAUTHIER, R. A. MELLOH (U.S. Army, Corps of Engineers, Detroit, MI), T. E. CROLEY, II, and H. C. HARTMANN (NOAA, Great Lakes Environmental Research Laboratory, Ann Arbor, MI) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1129-1140. refs

The Lake Superior Water Supply Study, a cooperative U.S. and Canadian pilot program for the total Great Lakes system is described. The study incorporates integrated, multilevel, and multisensor observations of hydrometeorologic conditions into the development of dedicated hydrologic forecast models for the lake. Results of periodic airborne gamma radiation snowpack measurements are presented, and plans for future airborne soil moisture surveys are discussed. The application of point, line, and areal observations to water supply forecast modeling for Lake Superior is described. The Large Basin Runoff Model, extended to forecast water supplies to Lake Superior, is being tested and/or modified to incorporate remotely sensed data in the future. Expected results and future program directions for data collection and modeling are presented. D.H.

A86-21215#

SATELLITE MICROWAVE RADIOMETRY OF SNOW COVER

M. HALLIKAINEN (Helsinki University of Technology, Espoo, Finland) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1405-1414. refs

The major factors contributing to the brightness temperature of snow-covered terrain are discussed, including the dielectric and scattering properties of snow, the dielectric properties of soils, and the effect of surface types. The effect of various surface types (forests etc.) to the brightness temperature is determined experimentally. Opacity contributions from the water vapor, liquid water and oxygen in the atmosphere are reviewed briefly. An algorithm to retrieve the water equivalent of snow cover from 18 GHz and 37 GHz brightness temperature data is presented. Author

A86-21217*# Howard Univ., Washington, D. C.

EVALUATION OF THE SATELLITE DERIVED SNOW COVER AREA - RUNOFF FORECASTING MODELS FOR THE INACCESSIBLE BASINS OF WESTERN HIMALAYAS

B. DEY (Howard University, Washington, DC) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1425-1432. refs
(Contract NAG5-224)

In this study, the existing seasonal snow cover area runoff forecasting models of the Indus, Kabul, Sutlej and Chenab basins were evaluated with the concurrent flow correlation model for the period 1975-79. In all the basins under study, correlation of concurrent flow model explained the variability in flow better than by the snow cover area runoff models. Actually, the concurrent flow correlation model explained more than 90 percent of the variability in the flow of these rivers. Compared to this model, the snow cover area runoff models explained less of the variability in flow. In the Himalayan river basins under study and at least for the period under observation, the concurrent flow correlation model provided a set of results with which to compare the estimates from the snow cover area runoff models. Author

A86-21240#

AIRBORNE MEASUREMENTS OF FRESHWATER ICE ALBEDOS

G. A. LESHKEVICH (NOAA, Great Lakes Environmental Research Laboratory, Ann Arbor, MI) and N. J. REID (Moniteq, Ltd., Concord, Canada) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1677-1687. refs

The albedos of open water and four major freshwater ice types were measured under clear skies from an altitude of approximately 300 m, using a programmable band spectral radiometer onboard a U.S. Coast Guard helicopter. The instrument is capable of making simultaneous radiance and irradiance measurements in the visible and near-infrared range (400-1100 nm). The ice types (on southern Lake Huron, March 26, 27, 1984) included refrozen slush, densely consolidated brash, large floes in a black ice matrix, and skim ice. Irradiance measurements wee made from ground level, between the airborne radiance measurements, so as to avoid possible attenuation due to the helicopter rotor blades. Radiance measurements were averaged for three passes and then machine processed with the irradiance data, to obtain reflectance values covering the wavelength range from 430 to 1100 nm for each surface type. D.H.

A86-21252#

EXTRACTION OF TOPOGRAPHIC NETWORKS FROM DIGITAL ELEVATION DATA

L. E. BAND (Hunter College, New York) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1795-1801. refs

Image processing techniques are used to extract and synthesize stream canyon networks from a digital elevation model of a set of mountainous watersheds. The methods involve a multi-step approach where pixels are first nominated to lie along a canyon based on local topography, and then successively grown and refined into coherent network structures. The resulting stream graphs may serve as the topological basis of a distributed hydrologic information system and is well suited for use in watershed runoff simulation. Author

A86-21257#

EFFECT OF ANTARCTIC ICE CRYSTALS AND AEROSOLS ON THE POLARIMETRY AND PHOTOMETRY OF THE ANTARCTIC SKY

W. G. EGAN (Lamont-Doherty Geological Observatory, Palisades, NY) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1845-1854. Navy-supported research. refs
(Contract NSF 81-15231)

This paper represents a progress report on the applicability of the Dave spectral polarimetric and photometric atmospheric model to the Antarctic summer sky containing ice clouds. Although the model is based on plane parallel layers, it was found to be valid in predicting the photometry and polarimetry between 0.400 and 1.0 microns within a factor of approximately two. Additional observations were made at 0.36-micron and to 1.6-microns wavelengths. Radiosonde observations were used as supplementary input data for ice cloud location. The Mie scattering calculations assumed spheres of diameters between 0.458 and 45.8 microns as approximating the scattering properties of ice crystals; comparisons to the phase function of columnlike hexagonal prisms showed the assumption to be reasonable. The observed optical depths are strongly dependent on the acceptance angle of the sun photometer because of the strong solar aureole. However, the amount of precipitable water may be accurately determined with a 2 degree FOV photometer using the ratio of two wavelengths, one strongly absorbing band for H2O and the other transmitting. Author

A86-21260#

A SIMPLE APPROACH TO ESTIMATE CLIMATOLOGICAL VARIABLES AT UNGAUGED POINTS FROM SATELLITE IMAGES AND SCARCE GROUND DATA TWO CASE STUDIES ABOUT RAINFALL AND SUNSHINE DURATION

D. CREUTIN, Y. FREIN, S. GALLE, P. LACOMBA, and C. OBLED (Grenoble I, Universite, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1873-1882. refs

A86-21261#

USE OF AIRBORNE MULTISPECTRAL SCANNER DATA FOR QUANTITATIVE WATER QUALITY STUDY OF THE TANSHUI RIVER

C. WU, C. LU, and W. CHENG (Energy and Mining Research/Service Organization, Taipei, Republic of China) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1885-1893. refs

Remotely sensed data were obtained from four flight lines flown over the Tanshui River watershed in northern Taiwan using an airborne Daedalus model 1260 eleven-channel Multispectral Scanner (MSS). At the same time, water samples from sixteen stations were acquired to measure fourteen water quality parameters in the laboratory. The measurements of water truth were used to calibrate the MSS data by the stepwise regression technique. All water quality parameters showed high correlation with the airborne data. A density slicing technique was exploited to produce thematic maps showing the relative quantitative distribution of water quality variables in the target areas. D.H.

A86-21265#

HYDRODYNAMIC MODELLING FOR DETERMINATION OF SUSPENDED SEDIMENT CONCENTRATIONS IN THE ASWAN RESERVOIR USING SATELLITE DATA

S. E. SMITH (Ohio State University, Columbus), A. EL DARWISH (Aswan High Dam Authority, Egypt), and A. AYOUB (Egyptian Academy of Scientific Research and Technology, Cairo, Egypt) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1929, 1930.

A86-22646

REMOTE SENSING INLAND WETLANDS - A MULTISPECTRAL APPROACH

J. R. JENSEN, M. E. HODGSON, R. CHRISTENSEN (South Carolina, University, Columbia), H. E. MACKEY, JR. (Du Pont de Nemours Savannah River Laboratory, Aiken, SC), L. R. TINNEY (EG&G, Inc., Energy Measurements Group, Las Vegas, NV) et al. Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, Jan. 1986, p. 87-100. refs
(Contract DE-AC09-76SR-00001)

Airborne Multispectral Scanner (MSS) data, large-scale aerial photography, and Landsat MSS and Thematic Mapper (TM) data were used to map a variety of wetland conditions along the Savannah river watershed in South Carolina. Predawn thermal infrared MSS imagery were analyzed to map the spatial distribution and migration of thermal effluent entering a portion of the Savannah river floodplain and the Savannah River below Augusta, Georgia. Daytime airborne MSS data were used to classify specific wetland vegetation types and associate them with their apparent (remotely sensed) temperature. Large-scale, multiple date aerial photography was ideally suited to follow the vegetational changes associated with the thermal discharges into the floodplain. Landsat MSS imagery obtained in the spring was used effectively to map the entire Savannah River watershed. Landsat TM imagery obtained in the summer was of limited use in regional wetland mapping. Author

A86-22846

THE POTENTIAL USE OF SPOT HRV IMAGERY FOR ANALYSIS OF COASTAL SEDIMENT PLUMES

L. E. BAND (Hunter College, New York), H. L. MCKIM, and C. J. MERRY (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, NH) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 199-204. Army-supported research. refs

The use of SPOT high resolution visible data obtained on July 7, 1984 to monitor sediment movement in and around the Hart-Miller Island complex is examined. The application of the edge detection technique (Sobel operator) to the SPOT image is studied; two sets of edge segments that follow the boundaries of the major sediment plumes are generated, with edge intensity stronger nearer the source. The spatial pattern of the plume edges, and tonal and textural differences on the image are investigated. Analysis of the SPOT image reveals that source and transport direction of the plumes, and concentrations of suspended sediments are observed. I.F.

A86-22848* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.

SPATIAL ANALYSIS IN RECREATION RESOURCE MANAGEMENT FOR THE BERLIN LAKE RESERVOIR PROJECT

H. A. EDWARDO, M. KORYAK (U.S. Army, Engineer District, Pittsburgh, PA), M. S. MILLER (NASA, Goddard Institute for Space Studies; Sigma Data Services Corp., New York), H. WILSON (NASA, Goddard Institute for Space Studies; Columbia University, New York), C. J. MERRY (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, NH) et al. IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, WA, American Society of Photogrammetry, 1984, p. 209-219.

Spatial analysis of geographic information systems and the acquisition and use of remotely-sensed data within the U.S. Army Corps of Engineers is an emerging Technology Work units have been developed under te Remote Sensing Research and Development Program, which are most relevant to the productive needs of the Corps in both the military and civil works missions. Corps participation in the SPOT simulation champaign is one such example of this research. This paper describes the application of spatial analysis and remote sensing in recreation resource managmaster planning at the Berlin Lake Reservoir Project within the Pittsburgh District. SPOT simulator data was acquired over Berlin Lake, Site No. 10, on July 8, 1983. The first part of this paper describes the background of the U.S. Army Corps of Engineers and the Berlin Lake project, the geographic information system being developed, and the planned use of SPOT and similar data. The remainder of the paper describes the results on an analysis of the simulated SPOT data conducted at the NASA Goddard Institut for Space Studies. Author

A86-22850

VEGETATIVE COVER AND HYDROLOGIC TRANSPORT STUDIES IN THE BITUMINOUS COAL FIELDS OF PENNSYLVANIA USING SIMULATED SPOT DATA

N. F. PARKS, K. F. CONNORS, G. W. PETERSEN, T. W. GARDNER, J. R. EYTON (Pennsylvania State University, University Park) et al. IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 229-238. refs
(Contract DE-AC02-83ER-60182)

Simulated SPOT data have been assessed for delineation of vegetation and hydrologic transport processes in a humid coal mining region of central Pennsylvania. The data were collected on July 8, and corresponding Landsat-4 data were collected on July 7, 1983. Previously-collected ground truth and aerial photographs facilitated evaluation. Image analysis and digital classification techniques were used, with emphasis on classification of vegetation and coal spoil surfaces. Spoil pile surface features are important in monitoring reclamation success, including the establishment of vegetation cover, initiation of gully development, and the production of acid mine drainage. Different vegetation species, age classes, and cover densities were separated by maximum likelihood classification. The Euclidean distance classifier differentiated among spoil lithologies, and between water bodies that were affected by acidic mine drainage and those that were unaffected. This research demonstrated the potential role of SPOT data in creation of an integrated data base to support studies of energy-related surface and subsurface waste transport systems. Author

A86-24520* Alabama Univ., Huntsville.

INFRARED REMOTE SENSING OF CONVECTIVE CLOUDS AND AMOUNT OF RAINFALL OVER THE TIBET PLATEAU AREA

R. J. HUNG, J. M. LIU (Alabama, University, Huntsville), and R. E. SMITH (NASA, Marshall Space Flight Center, Huntsville, AL) Annales Geophysicae (ISSN 0755-0685), vol. 3, Nov.-Dec. 1985, p. 767-775. refs
(Contract NAS8-33726)

The pattern of heavy rainfall in the Tibet Plateau area is usually preceded by a high growth rate of the convective clouds followed by a rapid collapse of the cloud top as observed on satellite infrared remote images. This study shows that the amount of rainfall can be estimated from the volumetric dissipation of clouds per unit area passing through the area of interest. This study also shows that the ratio of ground observed rainfall over the volumetric dissipation of clouds per unit area is constant for relatively heavier rainfall, and is smaller for very light rainfall. This is due to the fact that the lighter rainfall consumes higher percentage of rain drops in evaporation before they reach the ground. Author

A86-24616

GEOMORPHOLOGICAL AND LAND-USE ANALYSES OF COLOR IR PHOTOGRAPHS FROM THE SPACELAB-1 MISSION [INTERPRETATION D'UN COUPLE DE PHOTOGRAPHIES INFRAROUGE COULEUR DE LA MISSION SPACELAB-1 DANS LES DOMAINES DE LA GEOMORPHOLOGIE ET DE L'OCCUPATION DU SOL]

Y. DEWOLF, F. JOLY (Paris VII, Universite, France), J. BIESSAC, and A. SIMONIN (CNRS, Centre d'Etudes et Realisations Cartographiques Geographiques, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 99, 1985, p. 35-39. In French.

Several Spacelab-1 color IR photographs of the North Paris Basin were combined with each other to perform geomorphological and land use analyses of stereoscopic views of the region. The survey covered the steep cliffs to the sand dune beaches of the coast where the estuaries of the Seine enter the Atlantic. The photographic resolution was high enough to discern the petroleum terminal at Cape Antifer and the timber forests near Dieppe. The hydrologic drainage of the region was mapped at a 1:820,000 scale, including the areas which receive more drainage and the gravel basins cut by the rivers in the scenes. Lineaments, escarpments and terrain relief were also revealed. Few tree species could be identified because of the season of the photographs, while the layout of the farms, cities and the road systems were easily identified. M.S.K.

A86-25480

EVALUATION OF THE QUALITY OF SURFACE WATER ON THE BASIS OF MULTISPECTRAL REMOTE-SENSING IMAGERY [OTSENKA KACHESTVA POVERKHNOSTNYKH VOD SUSHI PO MNOGOZONAL'NOI AEROKOSMICHESKOI VIDEOINFORMATSII]

A. A. GITELSON, G. P. KEIDAN, and V. N. SHISHKIN (Rostovskii Gosudarstvennyi Universitet, Rostov-on-Don, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Nov.-Dec. 1985, p. 28-35. In Russian. refs

An algorithm based on radiation parameters invariant with respect to survey conditions is developed for assessing surface-water quality. Interpretation signatures are identified that can be used to determine the hydrochemical and hydrobiological indicators of water objects from radiation characteristics. Radiation vs. concentration relationships for mesotrophic waters are examined with a view to developing an a priori data bank for the interpretation of multispectral imagery. B.J.

N86-15989*# Maryland Univ., College Park. Remote Sensing Systems Lab.

ACTIVITIES OF THE PILOT LAND DATA SYSTEM PROJECT Interim Progress Report

J. K. SIRCAR, Principal Investigator 15 Nov. 1985 5 p ERTS
(Contract NAG5-512)
(E86-10023; NASA-CR-176377; NAS 1.26:176377) Avail: NTIS HC A02/MF A01 CSCL 05B

The University of Maryland's Remote Sensing Systems Laboratory submitted to NASA/Goddard an interim progress report on the work being conducted within its Pilot Land Data System IPLDS project. The Remote Sensing Systems Laboratory addressed the following tasks: (1) identify data types and data sources needed to describe the selected test sites in collaboration with Goddard's Hydrological Sciences Branch; (2) define the procedures necessary to access/acquire this data; (3) conduct meetings with the PLDS Systems Engineering Group to identify functional specification priorities for PLDS development; (4) assemble documentation on historical remotely sensed imagery and transfer of such information to the PLDS Data Management Group; (5) collect data identified by Goodard's Hydrological Sciences Branch for data set inventory in PLD; (6) develop a Workstation-PLDS system interface over high speed lines, (7) develop and test through a Phase 1 demonstration of a micro workstation to access PLDS; and (8) establish interdepartmental agreement of development of computer link for electronic access of water resources data from USGS.
Author

N86-16704# Pacific Northwest Lab., Richland, Wash.

OPPORTUNITIES AND DIFFICULTIES ASSOCIATED WITH USING LANDSAT THEMATIC MAPPER DATA FOR DETERMINING SURFACE WATER TEMPERATURES

G. W. WUKELIC, J. C. BARNARD, G. M. PETRIE, and H. P. FOOTE Jun. 1985 14 p refs Presented at the NASA LIDQU Final Symposium: LANDSAT Image Data Quality Analysis Meeting, Indianapolis, Ind., 9 Sep. 1985
(Contract DE-AC06-76RL-01830)
(DE85-017925; PNL-SA-13259; CONF-8509161-1) Avail: NTIS HC A02/MF A01

This paper describes results of research efforts to estimate surface-water temperatures using LANDSAT 4 and 5 TM thermal band data. Recent research involved the analysis of day- and night-time TM Band 6 data in both corrected (P tape) and uncorrected (A tape) formats. Results reported are for (1) a reservoir reactor cooling system (PAR Pond) at the Department of Energy's (DOE) Savannah River Plant in Aiken, South Carolina, and (2) the Columbia River adjacent to the DOE's Hanford site in southeastern Washington State. Differences between LANDSAT-derived surface water temperatures and ground truth values before and after correcting for atmospheric effects (using LOWTRAN) are described. The results substantiate the consistent performance of the LANDSAT TM thermal sensor for providing potentially useful estimates of relative and absolute temperatures for large water bodies within and between TM scenes. In addition, technical difficulties encountered that currently limit routine use of such data for environmental monitoring, such as calibration, mixed pixel phenomena, and atmospheric effects are addressed. DOE

N86-18357# Katholieke Universiteit te Leuven (Belgium). Remote Sensing Lab.

APPLICATION OF METEOSAT DATA FOR REMOTE SENSING OF EARTH RESOURCES: EARSEL WORKING GROUP 7 REPORT

R. GOMBEER *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 43-44 Jun. 1985
Avail: NTIS HC A12/MF A01

Algorithms to map rainfall, net radiation, evapotranspiration, soil moisture availability, thermal inertia, and germination were developed, using METEOSAT data and standard reports from synoptic weather and rainfall stations in arid zones. The algorithms were applied to a test area in Mali to map and monitor these variables during a test period of 18 days at the beginning of the growing season. Results demonstrate the ability of METEOSAT to provide consistent surface meteorological maps over large areas, and unique information in areas where ground stations are scarce or existing measurements unreliable. Results on rainfall, evapotranspiration, germination and biomass were represented in color maps. Author (ESA)

N86-18358# Bristol Univ. (England).

SATELLITE REMOTE SENSING IN HYDROLOGY

R. W. HERSCHY (ESA/ESTEC, Noordwijk, Netherlands), E. C. BARRETT, and J. N. ROOZEKRANS (Environmental Analysis and Remote Sensing, Delft, Netherlands) *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 47-53 Jun. 1985
Avail: NTIS HC A12/MF A01

The needs of satellite remote sensing techniques for hydrology and water management were studied. The status of remote sensing in hydrology is described and existing and future satellite systems are discussed. Further requirements of satellite sensors for hydrology and water management are considered. The results of a questionnaire to 150 European hydrologists are summarized and the hydrological requirements from satellite remote sensing presented. Author (ESA)

N86-18367# Institute for Land and Water Management Research, Wageningen (Netherlands).

EVAPORATION IN DESERTS: PHYSICAL ASPECTS AND REMOTE SENSING TECHNIQUES

M. MENENTI *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Oppportunities: Systems, Sensors, and Applications p 99-106 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

Physical processes which contribute to evaporation of bare soil under desert conditions are discussed. A combination equation to calculate actual evaporation when the evaporation front is located below the soil surface is presented. It is shown that thermal convection of soil air in the top soil can occur and that heat and vapor flow can be contrary, because of the density gradient induced by vapor production. The concept of thermal admittance of the surface is discussed in relation to the thermal properties of soil layers. Knowledge of the thermal properties of the soil layers is needed, since soil heat flux is the driving force for evaporation when it takes place below the soil surface. The application of satellite data to study these processes is discussed, and a case-study in the Lybian desert is presented. The relevance of groundwater losses by evaporation for a proper appraisal of groundwater resources in deserts is emphasized. Author (ESA)

N86-18381# Consiglio Nazionale delle Ricerche, Milan (Italy). Remote Sensing Dept.

SNOW MAPPING FROM LANDSAT IMAGERY

G. BOLZAN, P. A. BRIVIO, L. CILLERAI, A. DELLAVENTURA, and A. RAMPINI *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 211-216 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

A dedicated system for the analysis of satellite images and snow cover measures drawing, and multispectral scanner results obtained by its application to a series recorded over Cordevole River basin test site (Italy) are presented. The system includes procedures for the processing, classification, and display of the images, allowing the analyst to drive and control the whole process. Comparison between snow maps automatically compiled and photointerpretation maps shows a good agreement.
Author (ESA)

N86-18385# Mullard Space Science Lab., Dorking (England).
THE ERS-1 OBSERVATIONS OF LAKES FOR CLIMATE RESEARCH
I. M. MASON, C. G. RAPLEY, F. A. STREET-PERROTT (Oxford Univ.), and M. GUZKOWSKA (Oxford Univ.) *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 235-241 Jun. 1985 refs Sponsored by ESA and UK Science and Engineering Research Council
Avail: NTIS HC A12/MF A01

Prospects for remote sensing of lake volume fluctuations for climate research using ERS-1 are reviewed. The importance of monitoring lake volumes for climate and paleoclimate research, and how closed lakes respond to climate are considered. It is shown that it is necessary to monitor levels and areas simultaneously, which can be achieved using the Radar Altimeter (RA) and the Along Tracking Scanning Radiometer (ATSR) on ERS-1. For any frequency band the ATSR and RA can measure small (10 %) aridity variations. The ATSR has virtually global coverage, and with a reasonably long repeat track period (35 days) the RA could measure up to 100 closed lakes globally and many more open ones. The ERS-1 can provide an important climate record on a global scale. Author (ESA)

N86-18769# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Lab.
MILITARY HYDROLOGY. REPORT 8: FEASIBILITY OF UTILIZING SATELLITE AND RADAR DATA IN HYDROLOGIC FORECASTING
B. T. MIERS and G. L. HUEBNER Sep. 1985 69 p
(Contract DA PROJ. 4A7-62719-AT-40)
(AD-A160615; WES/MP/EL-79-6-8) Avail: NTIS HC A04/MF A01 CSCL 08H

The army that has the capability of predicting hydrologic conditions throughout the battlefield area would have a tactical advantage on both offense and defense. Such a capability, though, is dependent on a means for accurately monitoring and forecasting precipitation, the dominant driving element for dynamic hydrologic phenomena such as soil moisture and streamflow. In the context of a tactical environment with its associated constraints, the potential utility of satellites and radars was evaluated. It was concluded that, in the 1980s time frame, only the weather radar can provide rainfall estimates meeting requirements of the military hydrologist. Common components and operational characteristics of existing radar systems are discussed, and a set of general specifications for a tactical weather radar system is included. GRA

N86-19696# Helsinki Univ. of Technology, Espoo (Finland).
MAPPING OF SNOW BY PASSIVE AND ACTIVE MICROWAVE SENSORS
M. HALLIKAINEN and R. KUITTINEN (Technical Research Centre of Finland, Espoo) *In* ESA The Use of Satellite Data in Climate Models p 131-132 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

A snow-related research program for ERS-1 is proposed. Discrimination of wet snow (melting season) from bare soil is possible using the SAR and the wind scatterometer. Special attention should be paid to observing the effects from various land-cover categories to the discrimination accuracy. With the SAR, the 25m resolution makes it possible to distinguish in a detailed manner backscattering contributions from land-cover categories. With the wind scatterometer, the situation is comparable to corresponding Nimbus-7 SMMR studies (resolution tens of kilometers). The data should be complemented with airborne gamma spectrometer measurements, NOAA data, Nimbus-7 SMMR (or DMSP/N-ROSS SSM/I) data, and in situ measurements. Finland is an excellent test site for snow studies. Author (ESA)

N86-19697# Innsbruck Univ. (Austria). Inst. of Meteorology and Geophysics.
MONITORING OF SNOW AND LAND ICE PARAMETERS: POSSIBILITIES AND CONSTRAINTS OF SAR AND MICROWAVE IMAGING SYSTEMS
H. ROTT *In* ESA The Use of Satellite Data in Climate Models p 133-135 Sep. 1985 refs
Avail: NTIS HC A10/MF A01

Global monitoring of cryospheric parameters using satellite-borne radar and microwave imaging systems, especially ERS-1, is considered. The different capabilities regarding dry and wet snow cover clearly indicate a combination of SAR and microwave radiometer as optimum snow sensor. However major differences in areal coverage and spatial resolution complicate the synergistic use of these sensors. An SMMR-like sensor provides global coverage in 3 days of operation. The spatial resolution (30 km in the 37 GHz-channel) is adequate for large scale climate studies. An improvement of resolution to a few kilometers appears feasible without major technical problems. The ERS-1 Active Microwave Instrument narrow swath and the restrictions in sensor operation time mean that the system can be used for detailed studied only over a few limited areas. The ERS-1 SAR system has only supplementary functions for land cryosphere monitoring and is of limited value for climatological studies on snow and land ice. A potential operational application is the surveillance of lake and river ice. Author (ESA)

N86-19804# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
EFFECTS OF MOUNTAIN RANGES ON MESOSCALE SYSTEMS DEVELOPMENT Final Report, 15 Apr. 1982 - 31 Jul. 1985
E. R. REITER, J. D. SHEAFFER, M. A. KLITCH, and R. L MCANELLY Sep. 1985 191 p
(Contract AF-AFOSR-0162-82)
(AD-A161136; AFOSR-85-0924TR) Avail: NTIS HC A09/MF A01 CSCL 04B

Synoptic studies addressed themselves to a moisture bridge over Central America which often is tied to severe weather in the Rocky Mountain area. Heavy flooding events over eastern China have been tied to preferred positions of blocking highs and to vortices developing over the Plateau of Tibet. Mesoscale convective systems over, and to the east of, the U.S. Rocky Mountains have been investigated by individual case studies as well as by satellite composite imagery. There appears to be a well-defined sequence of events, whereby first the average precipitation rate maximizes, then the volumetric rain rate, and finally the rain area. Appendices: a satellite climatology of intense convective storms from manually digitized hourly cloud cover fields; meso-beta-scale characteristics of the meso-alpha-scale convective complex; evolution of precipitation and upper air characteristics during the life-cycle of a composite mesoscale convective complex; the precipitation life cycle of mesoscale convective complexes. GRA

N86-20253# Joint Publications Research Service, Arlington, Va.
DETERMINING WATER SURFACES IN NORTHWESTERN BOHEMIA FROM SATELLITE DATA Abstract Only
K. KIRCHNER, J. KOLAR, and S. PLACHY *In its* USSR Report: Space (JPRS-USP-86-001) p 149 13 Jan. 1986 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 1, Jan. - Feb. 1985 p 47-51 Original language document was announced in IAA as A85-29906
Avail: NTIS HC A03

Satellite data were used in determining surface water formations in the territory of Czechslovakia. An analysis is given of a photograph of northwestern Bohemia which is characterized by a well-expressed dynamics of surface changes attributable to economic activity. The photograph was taken from the LANDSAT satellite on 30 June 1978. One of the manifestations of these changes is the appearance or disappearance of some water bodies in a relatively short time interval which necessitates corrections to topographic and geographic maps. A test range with an area of about 600 square kilometers was defined in the studied area. This is a mining region where open pits and mine tailings become filled or flooded with water. The water surfaces have different extents and configurations determined by the nature of the depression, hydrogeological and climatic conditions. The initial form of the information used in the study was the spectral characteristic of the water surface. The information used in the classification of water surfaces as from a single spectral channel for the near-IR region. A total of about 135,000 brightness values were obtained for the test range. Some 96 water surfaces of different extent were detected. These image data were compared with water surfaces on topographic maps at 1:25,000 and 1:50,000 and water surfaces on black-and-white panchromatic aerial photographs at 1:20,000. It was possible to make reliable identification of water bodies with an area greater than 1 hectare. R.J.F.

N86-20446# Joint Publications Research Service, Arlington, Va.
RADAR OBSERVATIONS OF RIVER OVERFLOWS FROM OUTER SPACE Abstract Only
A. P. PICHUGIN, A. S. GAVRILENKO, A. G. GRIBUNIN, L. V. YELENSKIY, A. I. KALMYKOV, and V. P. SHESTOPALOV *In its* USSR Report: Space (JPRS-USP-86-002) p 63 10 Feb. 1986 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 284, no. 2, Sep. 1985 p 323-326 Original language translation was announced in IAA as A86-13984
Avail: NTIS HC A05

Cosmos-1500 sidelooking radar observations of the flooding of the Amur River in August 1984 are examined. It is concluded that remote-sensing radar images can be effectively used to monitor river flooding and to identify the basic features of flooded regions. The proposed radar-image processing method makes it possible to compute the areas of regions with different degrees of flooding as well as the percentage of land under water. B.J.

N86-20868# Joint Publications Research Service, Arlington, Va.
AN-30 PHOTOGRAPHY AIRPLANE OUTFITTED FOR CLOUD-SEEDING MISSIONS
T. KUZNETSOVA and A. PIMENOV *In its* USSR Report: Earth Sciences (JPRS-UES-86-001) p 1-2 10 Jan. 1986 Transl. into ENGLISH from Pravda Ukrainy (Kiev, USSR), 15 Aug. 1985 p 4
Avail: NTIS HC A04

The development of the AN-30M airplane mode, which can modify the weather is discussed. It has excellent flight qualities, high reliability, and modern pilotage-and-navigation equipment that permits flight routes and course changes in the semiautomatic mode and takeoffs during daytime and nighttime, in difficult weather conditions. Ammunition against precipitation (crystalline and other reagents) is loaded into containers placed inside and outside the aircraft on external mounts with a streamlined shape. The instruments evaluate weather conditions outside the airplane and decide at what altitude the cloud cover should be seeded and on the methods to be used. The AN-30M seeds clouds with frozen carbon dioxide granules. The plane can induce additional rainfall on farmlands, increase snow cover, and extinguish forest fires. E.A.K.

N86-20976# Oak Ridge National Lab., Tenn.
INVESTIGATION OF LANDSCAPE AND LAKE ACIDIFICATION RELATIONSHIPS Interim Report
R. M. RUSH, R. B. HONEA, E. C. KRUG, R. W. PEPLIES, J. E. DOBSON, and F. P. BAXTER Oct. 1985 39 p
(Contract DE-AC05-84OR-21400)
(DE86-001450; ORNL/TM-9754) Avail: NTIS HC A03/MF A01

This interim report presents the rationale and initial results for a program designed to gather and analyze information essential to a better understanding of lake acidification in the northeastern United States. The literature pertinent to a study of landscape and lake acidification relationships is reviewed and presented as the rationale for a landscape/lake acidification study. The results of a study of Emmons Pond in northwestern Connecticut are described and lead to the conclusion that a landscape change was a contributor to the acidification of this pond. A regional study of sixteen lakes in southern New England using LANDSAT imagery is described, and preliminary observations from a similar study in the Adirondack Mountains are given. These results indicate that satellite imagery can be useful in identifying types of ground cover important to landscape/lake acidification relationships. DOE

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DATA PROCESSING AND DISTRIBUTION SYSTEMS

Includes film processing, computer technology, satellite and aircraft hardware, and imagery.

A86-19410
A DIGITAL ELEVATION MODEL OF THE BARNES ICE-CAP DERIVED FROM LANDSAT MSS DATA
G. D. LODWICK and S. H. PAINE (Calgary, University, Canada) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 51, Dec. 1985, p. 1937-1944. Sponsorship: Department of Energy, Mines, and Resources of Canada. refs
(Contract DEMR-OSO-80-00357; DEMR-OST-83-00180)

Two Multispectral Scanner images, taken by Landsat-1 and -2, were analyzed to extract topographical data for the Barnes ice cap of Baffin Island. The images were obtained at high and low solar azimuth and elevation. A principal components analysis was performed on a 600 x 600 pixel area of band 7 of the summer scene and on the brightness values of the winter scene. Polynomial equations were defined to account for sensor delay, earth rotation, swath continuous errors and global continuous errors. Nearest neighbor resampling techniques were used to overlay the adjusted images. Histograms of the video response levels were then employed to plot slope values by the recorded reflectances. The method yielded height contour values which corresponded well with a map of the cap. It is concluded that the availability of two images which have the largest difference in the solar azimuth, combined with estimates of the maximum slopes present in a scene, can permit the characterization of topographical characteristics with a 50 m resolution. M.S.K.

A86-19479* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATMOSPHERIC EFFECTS ON REMOTE SENSING OF SURFACE REFLECTANCE
Y. J. KAUFMAN (NASA, Goddard Space Flight Center, Greenbelt; Maryland, University, College Park, MD) IN: Remote sensing; Proceedings of the Meeting, Arlington, VA, May 1, 2, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 20-33. refs

This paper reviews the atmospheric effects on remote sensing of surface reflectance. The scattering and absorption of sunlight by atmospheric molecules and aerosols affects the quality of images of the surface remotely sensed from satellites and aircrafts. The concentration and characteristics of the atmospheric aerosols vary from place to place and vary with time. The effect of atmospheric aerosols on the upward radiance depends on their optical thickness, scattering phase function and absorption. These parameters result from the aerosol concentration, composition, and the relative humidity. For high resolution images the aerosol scale height is also of importance. The radiative transfer theory that predicts the atmospheric radiances for a given surface and atmosphere is a well established theory for the case of uniform surfaces (or low resolution data). Some radiative transfer models exist for nonuniform surfaces and others are being developed. Recent field experiment and laboratory simulation data confirm the need for these models and can be used for their testing. It is shown that the atmospheric effect reduces the apparent resolution of satellite imagery and causes errors in the classification of surface fields. Suggestions for correction procedures are given. Such corrections can be based on ground observations, on satellite radiances above dark areas, or on climatologic information, depending on the accuracy of the corrections needed. The chosen correction algorithm depends also on the image resolution and the specific remote sensing application. Author

A86-19485

INTERPRETATION OF TOPOGRAPHIC RELIEF FROM DIGITAL MULTISPECTRAL IMAGERY

J. B. CAMPBELL, R. M. HARALICK, and S. WANG (Virginia Polytechnic Institute and State University, Blacksburg) IN: Remote sensing; Proceedings of the Meeting, Arlington, VA, May 1, 2, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 98-116. refs

The complexities of multispectral data and the large volumes of data involved affect the possibilities for an improvement of the data interpretation procedures. Such improvements will, therefore, depend upon the development of methods which minimize use of scene-specific information, or methods which reduce or simplify interactions with the analyst. The present paper provides a description of a procedure for the interpretation of drainage and topographic information from monoscopic multispectral images. A minimum of prior information pertaining to a scene is used, and only a modest degree of operator interaction occurs during the analysis of a scene. The considered procedure employs a variety of techniques derived from classical remote sensing. However, there is also a development of new methods which exploit knowledge of spatial and geometric relationships within the data. The discussed method permits the inference of a relative elevation model from a Landsat scene of mountainous terrain. G.R.

A86-19486* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

DATA SYSTEM CONSIDERATIONS FOR REMOTE SENSING

F. C. BILLINGSLEY (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Remote sensing; Proceedings of the Meeting, Arlington, VA, May 1, 2, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 117-128. NASA-supported research. refs

The availability of data obtained with the aid of Landsat and other remote sensing satellites provides potentially the possibility to study problems on a global scale. Difficulties arise, however, in connection with the diversity of data formats, archival conditions, and the need for data registration. Systems are being planned to test the ability to reduce some of these difficulties. Details regarding the given situation are examined, taking into account global problems which are being considered. These problems are related to the global carbon dioxide cycle, and the biogeochemical cycle. Attention is given to pilot data systems, considerations for spatial data, data format considerations, data quality considerations, aspects of data base design, and system aids. G.R.

A86-19499

A CLASS OF NEW STATISTICAL DECISION ALGORITHMS FOR SOLVING PROBLEMS OF CIVIL SPACE REMOTE SENSING

N. A. NECHVAL (Rizhskii Institut Inzhenerov Grazhdanskoi Aviatsii, Riga, Latvian SSR) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 68-75.

A technique for analytically solving problems of civil space remote sensing is developed on the basis of statistical decision theory, estimation theory, and optimization theory. The technique, utilizing the statistical invariant coupling method, is applied to the specific problems of determining signal detection thresholds and remotely measuring the thickness of surface cover. The proposed approach is applicable to the study of detection anomalies on the earth surface, resource exploration, fishery management, and ship routing during winter navigation. B.J.

A86-19809

KNOWLEDGE-BASED MULTI-SPECTRAL IMAGE CLASSIFICATION

M. J. CARLOTTO, V. T. TOM, P. W. BAIM, and R. A. UPTON (Analytic Sciences Corp., Reading, MA) IN: Applications of digital image processing VII; Proceedings of the Meeting, San Diego, CA, August 21-24, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 47-53. refs

A new approach to the problem of classifying surface materials in satellite multi-spectral imagery is described and demonstrated in this paper. Surface material classes are defined heuristically using rules which describe the typical appearance of the material under specified conditions in terms of relative image measures. A knowledge-based approach allows expert knowledge of the domain to be used directly to develop classification rules. An expert system is currently being developed in the Zetalisp/Flavors programming environment on the Symbolics 3600 Lisp Machine. An example of its use in classifying Landsat Thematic Mapper imagery is presented. Author

A86-20857

ORDERING OF TIME-DIFFERENCE INFORMATION FROM REPEATED SPATIAL IMAGERY

S. E. INGEBRITSEN and P. SWITZER (Stanford University, CA) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 46-50. refs

The goal of the present study is to exhibit a time-differenced multiband spatial field in factored form so as to emphasize the spatially structured signal differences and isolate the spatially unstructured noise. The method used is a variant of the MAF procedure described in Switzer and Green (1984). The MAF procedure (Min/Max Autocorrelation Factors) is a general purpose technique which extracts p orthogonal linear combinations or factors of the p-variate data which have maximal to minimal spatial autocorrelation. Two examples of MAF-processed time-difference imagery are presented. The first example is from an area in the Okanogan Highlands province of Washington state; the second is from the western Carson Desert, Nevada. Both examples were generated from Landsat MSS image pairs. Author

A86-20858* Kent State Univ., Ohio.

THE SPATIAL STRUCTURE OF TERRAIN - A PROCESS SIGNAL IN SATELLITE DIGITAL IMAGES

R. G. CRAIG (Kent State University, OH) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 51-54. refs

(Contract NAG5-165; NAS5-26111)

Pattern recognition procedures applied to Landsat imagery carry an implicit assumption that the digital data are independently distributed. That assumption is incorrect over virtually any terrain. Deviations from independence occur because slopes follow a systematic pattern of variation arising from the slope-forming processes. That pattern can be identified using the stochastic process methodology of Box and Jenkins.Angles of adjacent slopes are autocorrelated and the bidirectional reflectance function transfers these systematic slope changes to the sensor. Imagery becomes autocorrelated through this transfer. Autocorrelation in the imagery can be removed through direct calculation from a digital elevation model or by use of stochastic process methodology. The latter has the advantage that the residuals are white noise; and it is applicable in any area, even where a D.E.M. is unavailable. The stochastic process signal can be used to study terrain processes. Author

A86-20659

APPLICATION OF THE THEORY OF REGIONALIZED VARIABLES TO THE SPATIAL ANALYSIS OF LANDSAT DATA

J. R. CARR (Missouri-Rolla, University, Rolla) and D. E. MYERS (Arizona, University, Tucson) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 55-61. refs

A regionalized variable is a random variable distributed in space. With respect to nearby variables, a regionalized variable is spatially correlated. That is, a regionalized variable is related to other variables as a function of the euclidean distance separating these variables. As the distance between two regionalized variables increases, for example, the two variables become more dissimilar. The theory of regionalized variables was developed to describe the spatial relationship between regionalized variables and to use this spatial information in estimating the value of a regionalized variable at an unsampled location. Landsat data represent spatial variations in reflected solar flux and the theory of regionalized variables was employed to quantify this spatial variance and hence demonstrate Landsat data to be regionalized variables. The benefit is the demonstration of a spatial processing technique based on the spatial structure shown by the Landsat data. Author

A86-20669*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE PILOT CLIMATE DATA SYSTEM

M. G. REPH, L. A. TREINISH, and P. H. SMITH (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 132-139. refs

The Pilot Climate Data System (PCDS) is an interactive scientific information management system for locating, obtaining, manipulating, and displaying climate-research data. The PCDS was developed to manage a large collection of data of interest to the National Aeronautics and Space Administration's (NASA) research community and currently provides such support for approximately twenty data sets. In order to provide the PCDS capabilities, NASA's Goddard Space Flight Center (NASA/GSFC) has integrated the capabilities of several general-purpose software packages with specialized software for reading and reformatting the supported data sets. These capabilities were integrated in a manner which allows the PCDS to be easily expanded, either to provide support for additional data sets or to provide additional functional capabilities. This also allows the PCDS to take advantage of new technology as it becomes available, since parts of the system can be replaced with more powerful components without significantly affecting the user interface. Author

A86-20670*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PILOT LAND DATA SYSTEM

P. J. CRESSY (NASA, Goddard Space Flight Center, Greenbelt, MD) and J. E. ESTES (California, University, Santa Barbara) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 140-147. refs

During the fall of 1983, the Information Systems Office of NASA's Office of Space Science and Applications assembled a Working Group to develop initial plans for a Pilot Land Data System (PLDS). Workshops coordinated planning and concept development activities between land-related and computer science disciplines, and examined land research requirements, information science technology requirements, PLDS architecture, and methodologies for system evaluation. The PLDS will be a limited-scale distributed information system to explore scientific, technical and management approaches to satisfy land science research needs. PLDS will pave the way for a Land Data System to improve data access, processing, transfer and analysis, fostering an environment in which land science information synthesis can occur on a scale not previously possible owing to limits to data assembly and access and efficiency of processing. Author

A86-20676

ADVANCED COMPUTER INTERPRETATION TECHNIQUES FOR EARTH DATA INFORMATION SYSTEMS

P. H. SWAIN (Purdue University, West Lafayette, IN) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 184-189. refs

Consideration is given to the primarily pixel-oriented methods for analyzing remote sensing data which are in common practice today. Advanced computer interpretation techniques take advantage of the diverse forms of information in geobased information systems of which remote sensing data is only a part. Instrumentation advances and developments in space technology continue to make more information available from the spectral domain. Innovative methods are used to represent and manipulate high-dimensional data of this nature. Image registration and rectification techniques have made it possible to draw together geographic information from a great diversity of sources. Sophisticated scene models and methods for information extraction aim to take advantage of the generalized scene context, of which spatial and temporal data are only the most familiar components. This tutorial paper surveys many of the advanced computer interpretation techniques now in use and considers the directions which future research in this area will take. Author

A86-20677

MULTISPECTRAL IMAGE CONTEXT CLASSIFICATION USING THE MARKOV RANDOM FIELD

R. M. HARALICK, M. C. ZHANG, and J. B. CAMPBELL (Virginia Polytechnic Institute and State University, Blacksburg, VA) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 190-200. refs

A new multispectral image context classification, which is based on a recursive algorithm for optimal estimation of the state of a two-dimensional discrete Markov Random Field, is presented. The implementation of the recursive algorithm is on a form of dynamic programming. Finally, experimental results with remote sensed multispectral scanner data using the recursive context classification are presented and contrasted with results from context free classification. Author

A86-20681#

PROCESSING OF SCANNED IMAGERY FOR CARTOGRAPHIC FEATURE EXTRACTION

S. P. BENJAMIN and L. GAYDOS (USGS, Menlo Park, CA) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 222-230. refs

Digital cartographic data are usually captured by manually digitizing a map or an interpreted photograph or by automatically scanning a map. Both techniques first require manual photointerpretation to describe features of interest. A new approach, bypassing the laborious photointerpretation phase, is being explored using direct digital image analysis. Aerial photographs are scanned and color separated to create raster data. These are then enhanced and classified using several techniques to identify roads and buildings. Finally, the raster representation of these features is refined and vectorized. Author

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AN APPLICATION OF EXPERT SYSTEMS TECHNOLOGY TO REMOTELY SENSED IMAGE ANALYSIS

W. K. ERICKSON and W. C. LIKENS (NASA, Ames Research Center, Moffett Field, CA) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 259-276. NASA-supported research. refs

In October of 1983, a project was initiated at NASA/Ames Research Center to design a prototype expert system capable of producing a preliminary land cover classification from an unsupervised classification of Landsat Multispectral Scanner (MSS) imagery and associated collateral data. This paper outlines the problem of determining land cover classes from an unsupervised classification, presents a brief overview of expert systems, and continues with a description of the design and current state of implementation of NASA/Ames' prototype Landsat MSS image analysis expert system. Author

A86-20692*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A DEVICE-INDEPENDENT INTERFACE FOR INTERACTIVE IMAGE DISPLAY

D. C. PERKINS, M. R. SZCZUR, J. OWINGS, and S. CONTRACTOR (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 325-330. refs

NASA's Goddard Space Flight Center (GSFC) has developed a Transportable Applications Executive (TAE) for use in implementing portable applications software that can be shared by different research projects. Since many of the supported disciplines require the interactive display and manipulation of remotely sensed images, a device independent Display Management Subsystem (DMS) was written as a TAE extension. The DMS attempts to abstract and standardize the device dependent functions that are used in the display and manipulation of image data on image analysis terminals. This paper explores the concept of DMS and the interface routines that are available to the applications programmer for use in developing a set of portable image display utility programs. Author

A86-20699* Kansas Univ., Lawrence.

USING SPATIAL LOGIC IN CLASSIFICATION OF LANDSAT TM DATA

J. W. MERCHANT (Kansas, University, Lawrence) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 378-385. refs
(Contract NGL-17-004-024)

A strategy for spatial/spectral classification of Landsat TM data is presented. The strategy is founded upon 'spatial logic', a logic that seeks to emulate important aspects of visual image interpretation. The carefully structured classification process begins with spectral stratification of the data into water, vegetated and non-vegetated pixels. A region growing algorithm is then used to define 'fields' of similar land cover composition. Fields are characterized by cover composition, size and neighborhood characteristics. A supervised iterative contextual classification algorithm is developed to assign final land use/land cover labels. Maps are generalized using a spatial post-processing technique. Positive, though preliminary, results are presented. Author

A86-20700*

A COMPARISON OF LANDSAT POINT AND RECTANGULAR FIELD TRAINING SETS FOR LAND-USE CLASSIFICATION

C. H. TOM (Hughes Aircraft Co., Englewood, CO) and L. D. MILLER (Nebraska Remote Sensing Center, Lincoln) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 387-398. Research supported by the Colorado State University and NASA. refs

Rectangular training fields of homogeneous spectroreflectance are commonly used in supervised pattern recognition efforts. Trial image classification with manually selected training sets gives irregular and misleading results due to statistical bias. A self-verifying, grid-sampled training point approach is proposed as a more statistically valid feature extraction technique. A systematic pixel sampling network of every ninth row and ninth column efficiently replaced the full image scene with smaller statistical vectors which preserved the necessary characteristics for classification. The composite second- and third-order average classification accuracy of 50.1 percent for 331,776 pixels in the full image substantially agreed with the 51 percent value predicted by the grid-sampled, 4,100-point training set. Author

A86-20701

AN EVALUATION OF THE ACCURACIES OF FIVE ALGORITHMS FOR MACHINE CLASSIFICATION OF REMOTELY SENSED DATA

M. H. STORY, J. B. CAMPBELL, and G. BEST (Virginia Polytechnic Institute and State University, Blacksburg) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 399-405. refs

Accuracies of five digital techniques applied to classify remotely sensed Landsat MSS data (of an area near Roanoke, VA) were assessed. The five algorithms, AMOEBA, ISODATA, BOSDEC, BCLAS, and Hypbox, vary considerably in terms of the information required for their use, which can be a limiting factor for their application. In terms of accuracy, the BOXDEC, BCLAS, and HYPBOX techniques were shown to be significantly more accurate than the AMOEBA and ISODATA. The BOXDEC technique displayed the highest degree of accuracy but took considerably more CPU time than other techniques and classified only 20.1 percent of the image. For a classification of the complete scene, the HYPBOX technique with the Bayes' rule option proved to be the most efficient (with respect to accuracy in relation to CPU time). I.S.

A86-21104*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CHANGES IN CLASSIFICATION ACCURACY DUE TO VARYING THEMATIC MAPPER AND MULTISPECTRAL SCANNER SPATIAL, SPECTRAL, AND RADIOMETRIC RESOLUTION

W. ACEVEDO, J. S. BUIS (NASA, Ames Research Center; Technicolor Government Services, Inc., Moffett Field, CA), and R. C. WRIGLEY (NASA, Ames Research Center, Moffett Field, CA) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 27-44. refs

The present paper provides the results of a factorial experiment designed to study the classification differences resulting from varying TM and MSS sensor resolution. Eight simulated data sets of various TM and MSS spatial, spectral, and radiometric resolutions were generated on the basis of Daedalus aircraft scanner data. It is pointed out that the current study provides more precise results than previous work, because more exact methods of data simulation with regard to the three factors were emphasized. Two methods of analysis are considered in the paper. To improve on earlier studies, efforts were made to collect an extensive amount of ground reference data. The summaries of classification accuracies for the

training sites in the factorial analysis are presented in a table.
G.R.

A86-21105#
NEW DIGITAL ELEVATION MAPPING SOFTWARE APPLIED TO SPOT SIMULATION STEREO DATA
R. K. VINCENT, P. K. PLEITNER, D. H. COUPLAND, H. SCHULTZ, and E. R. B. OSHEL (Geospectra Corp., Ann Arbor, MI) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 47-54. refs

This article is concerned with a new software package, called ATOM for Automatic Topographic Mapper, which is a purely digital method for extracting elevations from aerial or space stereo pair photographs. The photos are digitized, and the resulting data are sent to disks connected to a DEC VAX 11/750 computer. ATOM calculates elevations and produces digital terrain data from which elevation contour maps can be made in less than one third the time required by a Gestalt plotter to produce a contour map from the same photos. When ATOM was applied to 1:68,000 scale aerial photos with base-to-height ratios of 0.6, a measured minimum detectable elevation difference of 2.83 meters was achieved. A 7.1-meter contour map was produced by ATOM which compares favorably with a 1:24,000 scale topographic map produced by the U.S. Geological Survey for an area near Soap Holes Reservoir, WY. The application of ATOM to 10-meter SPOT data should produce topographic contour maps which in the best case would compare favorably with 1:50,000 scale topographic maps.
Author

A86-21106#
A SCENE-DEPENDENT APPROACH TO SYNTHESIZING DIGITAL ELEVATION MODELS
R. R. IRISH and A. H. STRAHLER (Hunter College, New York) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 55-59.

Extracting topographic models from digital imagery requires locating all possible conjugate image points in a stereo pair. This is usually accomplished in a computer environment by a correlation algorithm that employs a fixed window size. Matching success depends on strong local contrast and may suffer due to the fact that all image phenomena are treated equally. An optimal approach to image matching may be an algorithm whose window behavior is governed by the variety of image and terrain events present in the stereo pair. A scene-dependent algorithm that handles image phenomena individually by dynamic windowing is described.
Author

A86-21110#
DIGITAL PROCESSING TECHNIQUES FOR IMAGE MAPPING WITH LANDSAT TM AND SPOT SIMULATOR DATA
P. S. CHAVEZ, JR. (U.S. Geological Survey, Flagstaff, AZ) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 101-116. refs

To overcome certain problems associated with the visual selection of Landsat TM bands for image mapping, the author used a quantitative technique that ranks the 20 possible three-band combinations based upon their information content. Standard deviations and correlation coefficients can be used to compute a value called the Optimum Index Factor (OIF) for each of the 20 possible combinations. SPOT simulator images were digitally processed and compared with Landsat-4 Thematic Mapper (TM) images covering a semi-arid region in northern Arizona and a highly vegetated urban area near Washington, D.C. Statistical comparisons indicate that more radiometric or color information exists in certain TM three-band combinations than in the three SPOT bands. The image data were also subjected to high-pass spatial filtering with a percent of the original image added to the results, which allowed local detail to be enhanced in dark and bright regions while preserving brightness relationship along the various cover types. This combined with digital enlargement and low-pass filtering generated products useful for image mapping.
Author

A86-21140#
THE INTERPRETATION OF SAR IMAGERY AND THE SCATTERING OF MICROWAVES FROM NATURAL TERRAIN
M. S. SCIVIER, M. A. FIDDY, and R. E. BURGE (King's College, London, England) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 443-452. SERC-supported research. refs

Synthetic aperture radar (SAR), the interpretation of complex image data, and applications to remote sensing are described. In particular, ways in which interpretation may be improved by considering a more sophisticated model for the interaction of microwaves with natural terrain are suggested. The importance of combining theoretical development with the acquisition of actual SAR data is illustrated by reference to the forthcoming Shuttle Imaging Radar (SIR-B) shallow-water experiment.
Author

A86-21141#
STEREOPLOTTING OF SPOT IMAGES USING IGN/MATRA TRASTER SOFTWARE [STEREORESTITUTION D'IMAGES SPOT AL'AIDE DU LOGICIEL TRASTER IGN/MATRA]
C. VIGNERON (Matra, S.A., Bois-d'Arcy, France) and P. DENIS (Institut Geographique National, Saint-Mande, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 455-464. In French.

The French National Geographical Institute has developed software for the stereoscopic plotting of nonconventional images adapted to the MATRA TRASTER analytical stereoplotter. Two of the softwares are currently operational: one for underwater images (BATHY), the other for satellite images (SPOT). First results of the simulation of SPOT images for topographic and thematic mapping are given.
B.J.

A86-21148#
DEVELOPMENT OF DIGITAL IMAGE PROCESSING IN A DEVELOPING COUNTRY - A CASE STUDY FROM PAPUA NEW GUINEA
F. R. HONEY (Geoscan Pty., Ltd., West Perth, Australia), K. J. LYONS (Queensland, University, Brisbane, Australia), and G. L. WRIGHT (Western Australian Institute of Technology, Bentley) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 511-520. refs

The aim of the project was to develop, at a reasonable cost, an analysis system capable of analyzing digital images, and to assess its potential for mapping and environmental assessment in the Papua New Guinea region. Access to a PDP 11/34 computer was available through the Department of Surveying at the Papua New Guinea University of Technology. Australian Government aid enabled development of software to process Landsat data, with output produced by a lineprinter. The results from pilot studies were sufficiently encouraging to justify capital expenditure on a digital image processing capability. The paper describes the processing and display system, and highlights the capabilities of the system for use in environmental surveys. The basic system allowed, for the first time, the evaluation of digital remote sensor data in Papua New Guinea. It enabled development of expertise within the country and encouraged Papua New Guinea nationals to participate in developing techniques for solution of remote sensing tasks specific to their country.
Author

A86-21153#
GEOSCIENCE ANALYSES OF LANDSAT IMAGERY - AN IMAGE ATLAS OF CHINA
S. CHENG, X. HUANG, H. LI (Chinese Academy of Sciences, Institute of Remote Sensing Application, Beijing; National Remote Sensing Centre, People's Republic of China), and C. ZHENG (Chinese Academy of Sciences, Institute of Geography, Beijing, People's Republic of China) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 575-579.

The Atlas is a review of developments in the application of Landsat imagery to geoscience analysis in China. The contents of the Atlas reflect concepts and understandings of geosciences derived from the Landsat imagery. The Atlas concentrates on four themes: land cover and land use, hydrological dynamic phenomena, regional characters of landform, and lineament of geological structure. For each typical area, an interpretation map and an explanation were given along with a false color image composite from MSS. Twelve reference maps of country-wide analysis results of basic rules of distribution of physical geographic elements were collected, to help understand signification effects in the evolution of physical history, in the protection of ecological environment, and in the exploration of natural resources of China. Author

A86-21165*# Environmental Research Inst. of Michigan, Ann Arbor.
A SPECTRAL HAZE DIAGNOSTIC FEATURE FOR NORMALIZING LANDSAT THEMATIC MAPPER DATA
E. P. CRIST (Michigan, Environmental Research Institute, Ann Arbor) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 735-744. refs
(Contract NAS9-16538)

The effects of atmospheric haze on Thematic Mapper data, transformed to TM Tasseled Cap features, are illustrated by means of simulation. A spectral feature by which the amount of atmospheric haze may be inferred is derived and described for both simulated and actual TM data. Results presented for two actual TM scenes illustrate the diagnostic feature's sensitivity to changes in haze level as well as its insensitivity to scene-class-related variability. The method by which such a diagnostic feature might be incorporated into a haze normalization procedure is also discussed. Author

A86-21171#
DIGITAL ELEVATION MODELING WITH LANDSAT-3 RBV DATA
R. SIMARD (Canada Centre for Remote Sensing, Ottawa, Canada), R. J. OLIVIER, and E. PINA (Lausanne, Universite, Switzerland) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 825-834. refs

Improved results are presented in the use of digital stereo image processing techniques to effectively extract relief information to a good accuracy relative to available parallax information measured in pixel units. Digital Landsat-3 RBV data were used that were acquired over the Swiss Alps, in the mountainous Fribourg region. A mean difference of 9 m with a 41-m standard deviation between elevations obtained from the RBV data and those from accurate topographic maps has been measured. D.H.

A86-21180#
THE STATUS AND FUTURE OF SATELLITE IMAGE MAPPING BASED ON EXPERIENCE OF THE U.S. GEOLOGICAL SURVEY
A. P. COLVOCORESSES (U.S. Geological Survey, Reston, VA) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 957-960.

Three fundamental forms of maps are recognized herein. They are the line, thematic, and image form. Line and thematic maps are well defined but the image map is in a state of flux. Space systems now provide data in basically orthographic form which greatly simplifies the production of the image map. Moreover, the multispectral capability of space systems facilitates the use of the color mode when compared to aerial photography. Digital graphical information systems are now being developed on a global basis and the response from space which represents the image in multispectral form will undoubtedly be incorporated into such information systems. Thus, the capability of printing out the image along with more conventional map data will be a viable option. Author

A86-21199#
SPOT STEREOSCOPIC IMAGING - IMPLANTATION AND APPLICATIONS [LA STEREOSCOPIE AVEC SPOT - MISE EN OEUVRE ET APPLICATIONS]
H. GUICHARD (Spot Image, S.A., Toulouse, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1177-1188. In French.

A theoretical study of SPOT-satellite stereoscopic imaging is presented. Particular attention is given to a mathematical study of the mapping potential of SPOT; scene simulation; and rectification and plotting by spatial-triangulation segments. First results are presented. B.J.

A86-21202#
RECTIFICATION OF LANDSAT-4 THEMATIC MAPPER IMAGES WITHOUT CORRECTION DATA
A. H. BENNY (Royal Aircraft Establishment, Farnborough, England) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1245-1250.

The scan lines of Landsat-4 Thematic Mapper images suffer a variable relative displacement due to small variations in the scan-mirror velocity. The planned provision of information about the mirror movements did not occur for some otherwise valuable images. This paper describes a method for rectifying these images. Author

A86-21203*# Environmental Research Inst. of Michigan, Ann Arbor.
INFORMATION THEORETIC COMPARISONS OF ORIGINAL AND TRANSFORMED DATA FROM LANDSAT MSS AND TM
W. A. MALILA (Michigan, Environmental Research Institute, Ann Arbor) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1251-1262. refs
(Contract NAS5-27346)

The dispersion and concentration of signal values in transformed data from the Landsat-4 MSS and TM instruments are analyzed using a communications theory approach. The definition of entropy of Shannon was used to quantify information, and the concept of mutual information was employed to develop a measure of information contained in several subsets of variables. Several comparisons of information content are made on the basis of the information content measure, including: system design capacities; data volume occupied by agricultural data; and the information content of original bands and Tasseled Cap variables. A method for analyzing noise effects in MSS and TM data is proposed. I.H.

A86-21209#

EVALUATION OF TOPOGRAPHIC PROFILES AND GEOMETRIC RECTIFICATION ON A SEASAT SAR IMAGE

J. Y. GARINET (IBM France S.A., Paris, France) and R. JEANSOULIN (Institut National de Recherche en Informatique et en Automatique, Le Chesnay, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1333-1341. refs

A geometric rectification is required in the case of any study which uses images from different sources. The rectification procedure can become difficult, or even impossible, if areas with reliefs are involved. The arising problems are caused by the strong distortions which are produced in connection with the specific principle of the image formation employed in the case of a Synthetic Aperture Radar (SAR). The formation of a radar image is discussed along with details regarding the occurring geometric radar image distortions. Two approaches for achieving geometric correction are proposed. In a first step, a method of rectification based on the use of a digital terrain model (DTM) can be employed, while a second step involves the evaluation of topographic profiles. G.R.

A86-21218#

REGISTRATION AND CLASSIFICATION OF SIR-A, SEASAT AND LANDSAT MSS DATA OVER MONASTIR (TUNISIA)

PH. REBILLARD, P. N. PASCAUD (Societe Europeenne de Propulsion, Division de Traitement d'Images, Puteaux, France), H. HARRAN, and J. CHOROWICZ (Paris VI, Universite, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1433-1441. refs

An area located in northern Tunisia has been surveyed by both Seasat and SIR-A providing perpendicular radar illumination directions. The radar images are contrasted with the Landsat MSS images overlapping the same area. The synthetic aperture radar data were acquired in 1978 by Seasat and in 1981 by the shuttle imaging radar. The Landsat pictures were taken in 1978 and 1981. In this study, subareas of the SIR-A and MSS images are registered to the corresponding Seasat data. The test site is a 60 km by 40 km wide area which displays two playas. It is a low relief area with subdesertic climatic conditions. Registering multispectral and multitemporal data enables comparisons between the systems (radar vs MSS, and Seasat vs SIR-A), and changes detection in the desertification processes and on the surface of the playas. An unsupervised classification has been performed over the coregistered image data set. It clearly shows the strong boundary between the coastal plain and the subdesertic inland. Author

A86-21224#

A CONCEPT OF MULTI-SPECTRAL IMAGE DATA WITH ANALYTICAL PROGRAM STORED IN FLOPPY DISKET

T. SAKAI, K. SEYA, H. NISHIKAWA, J. OSHIMA (College of Industrial Technology, Narashino, Japan), and T. SUGIMURA (Remote Sensing Technology Center of Japan, Tokyo) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1499-1506.

This paper addresses a concept of multi-spectral image data with analysis program, in today's circumstances. If remotely sensed image data in a limited area are chosen and some analysis programs are attached together with the data, the user will instantaneously approech the utilization of the data by the disktop computer system. The authors construct a Landsat MSS data and a NOAA/AVHRR multi-spectral data of small area with some analysis function programs, and then store them in a 8 inch floppy disket. The image data stored in one floppy disket are constructed 400 lines by 512 pixels with 4 bands. The programs are written in BASIC of NEC PC-9801. This program can be easily transferred to the other computer models. An example of the utilization of this type of data was in laboratory for fishery in Japan, and may be further acceptable in the fields of natural environmental managements. Author

A86-21228#

PRINCIPLES FOR THE PROGRAMMING OF SPOT SATELLITE IMAGES [PRINCIPES DE PROGRAMMATION DES IMAGES DU SATELLITE SPOT]

B. CABRIERES, A. CARIOU, and G. PONCE (CNES, Toulouse, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1533-1539. In French.

The role of the SPOT Mission Center in the programming of SPOT images is decribed. The Center is designed to: (1) choose the satellite configurations that best satisfy user requirements; (2) develop the payload schedule; and (3) inform the user about the scenes acquired. B.J.

A86-21242#

A COMPARISON OF SOME CONTEXTURAL METHODS IN REMOTE SENSING CLASSIFICATION

N. L. HJORT and E. MOHN (Norwegian Computing Center, Oslo, Norway) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1693-1702. refs

A general formula for the posterior probability of a pixel belonging to a specified class, given the spectral vectors in the pixel and its immediate neighbors, is presented. The formula, involving both the distribution of classes and the distribution of spectral vectors given the classes, gives rise to a variety of contextural methods for the classification of remotely sensed data, all of which aim at a better performance than the classical rules of discriminant analysis that are currently used in most commercial systems. Some earlier published methods are reviewed, and some new procedures proposed. It is argued that the assumption often made that the spectral vectors are spatially uncorrelated given the classes becomes inadequate when applied to small pixels, i.e. high resolution satellites. A preliminary comparison of some of the methods, applied to a simulated SPOT scene in Norway, is included. Author

A86-21248#

THREE-COLOR REPRESENTATIONS OF LANDSAT IMAGES [REPRESENTATIONS TRICHROMIQUES DES IMAGES LANDSAT]

A. LEDUC (Rouen, Universite, Mont-Saint-Aignan, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1751-1758. In French.

The application of the three-color method (involving the superimposition of three primary colors) to the representation of Landsat-2 multispectral images is discussed. Visually significant associations were found to be limited, and channel decorrelation by factorial analysis did not yield the expected results. An analysis of the variability of the main factors via sampling of various windows extracted from Landsat scenes conforms the graphic results. It is concluded that Landsat data do not greatly lend themselves to representation by three-color imagery. This necessitates an improvement of the selectivity of radiometric sensors. B.J.

A86-21250#

MULTITEMPORAL DATA ANALYSIS BY EXTENDED RADIOMETRIC CORRECTION

T. KUSAKA, Y. KAWATA, and S. UENO (Kanazawa Institute of Technology, Ishikawa, Japan) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1775-1783.

A means is given of treating the problem that a variable direction of solar illumination makes it difficult to analyze multitemporal remote sensing data because CCT level counts vary greatly with illumination angle, which in turn varies with the seasons. An important correlation is noted between variations in band 6 and 7 CCT levels of Landsat multi-spectral scanners (MSS) and the local topographies in mountainous terrain. An approximation method is proposed to reject both the topographic and atmospheric effects from the Landsat MSS data. An application of the proposed method to the data proved that the rejection of the two effects was, to some extent, successfully done in mountainous terrain. D.H.

A86-21251#

DIGITAL MOSAIC PROCESSING

S. HORII, Y. OSHIMA, K. HIRAO (Toshiba Corp., Advanced Space Programs Dept., Kawasaki, Japan), I. KOHNO, and T. YOKOYAMA (Earth Resources Satellite Data Analysis Center, Tokyo, Japan) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1785-1794. refs

A computer-aided digital processing technique is described that can create a mosaic of Landsat images to cover an expanded area (for oil field exploration or other wide area research). The technique eliminates obtrusive joint lines, yields high-quality images for detailed analysis, and reduces the computing time. D.H.

A86-21253#

EDGE DETECTION PROBLEMS IN A MOUNTAINOUS REGION - APPLICATION TO THE 'ATLAS BLIDEAN'

A. OUSSEDIK, A. KHINECHE, and A. ABDELLAOUI (Conseil de l'Economie Nationale, Centre de Developpement des Techniques Avancees, Algiers, Algeria) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1803-1813. refs

The problem of edge detection in space imagery of mountainous regions is treated. The Blidean Atlas, a 1630-m mountain oriented east and west in the middle part of the Algiers Tellian chain in Algeria, is chosen as the subject of the investigation. The first general approach is to use space differentiation operators to characterize the edges of major physiographic units, but edges inside shaded slopes cannot be recognized. An edge detection process is proposed using local thresholding; it allows characterization of units in the shaded slopes. D.H.

A86-21267#

LAND USE MAPPING BY REMOTE SENSING IN THE MEDITERRANEAN REGION - DEVELOPMENT OF A SOFTWARE PACKAGE FOR PROCESSING LANDSAT DATA

R. MANIERE (Nice, Universite, France), M. POISSON (SODETEG-Teledetection, Valbonne, France), and M. LECHARPENTIER (Paris, Ecole National Superieure des Mines, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1937-1944. refs

A fully automatic procedure for land use classification using Landsat is described. By combining unsupervised (CLAMS system) and supervised techniques, the processing method provides optimal results and minimizes operator dependencies in the classification. The procedure is easily repeatable, and can be used to apply the same set of ground truth information to multidate imagery. At the same time, it provides a fairly low cost approach to land use inventories by remote sensing. Author

A86-22563

THE INTERCONNECTION BETWEEN THE OPTIMAL NUMBER OF PROCESSED SPECTRA AND THE SPATIAL RESOLUTION OF REMOTE SENSING DEVICES IN OBSERVATIONS OF NATURAL OBJECTS FROM SPACE [VZAIMOSVIAZ' OPTIMAL'NOGO CHISLA OBRABATYVAEMYKH SPEKTROV S PROSTRANSTVENNYM RAZRESHENIEM APPARATURY PRI DISTANTSIONNOM ISSLEDOVANII PRIRODNYKH OB'EKTOV]

A. I. IANOVSKII and E. A. IANOVSKAIA (AN BSSR, Institut Fiziki, Minsk, Belorussian SSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Sept.-Oct. 1985, p. 95-98. In Russian. refs

Criteria are proposed for estimating the spectral homogeneity of natural objects for remote sensing applications. Formulas are obtained for the minimum number of measurements required to calculate the spectral brightness coefficient of the natural object, assuming the spatial resolution of the spectrometer is about 10 percent. The application of the formulas to Multispectral Scanner (MSS) imagery is discussed in detail. I.H.

A86-22826

SPOT SIMULATION APPLICATIONS HANDBOOK; PROCEEDINGS OF THE SPOT SYMPOSIUM, SCOTTSDALE, AZ, MAY 20-23, 1984

Symposium sponsored by ASP and CNES. Falls Church, VA, American Society of Photogrammetry, 1984, 296 p. For individual items see A86-22827 to A86-22835, A86-22837 to A86-22853.

The SPOT satellite system is discussed, taking into account the organization and data distribution policy related to the SPOT program, the SPOT system conception and project status, SPOT simulation campaign methodology, approaches for insuring a mosaic with revisit flexibility capabilities, and the testing of SPOT satellite acquisition strategies over the U.S. Applications related to geology are examined, giving attention to an evaluation of SPOT simulator data for geologic mapping in the split mountain region, digital processing of SPOT simulator and Landsat TM data for the SP mountain region, evaluation of SPOT simulator data for the detection of alteration in Goldfield/Cuprite, preliminary evaluation of simulated SPOT data for cultural resource assessment, a review of SPOT imagery simulation at the Copper Canyon Cu-Au mining area, and new digital elevation mapping software applied to SPOT simulation stereo data. Other topics explored are related to agriculture, urban planning and cartography, water resources and environmental applications, and forestry. G.R.

A86-22829

SPOT SIMULATION METHODOLOGY - SIMULATED VS. SATELLITE IMAGE PARAMETERS

G. SAINT (CNES, Toulouse, France) and G. WEILL (SPOT Image Corp., Washington, DC) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 19-28.

The paper summarizes the technical background of the 1983 U.S. SPOT Simulation Data; it discusses the calibration, data acquisition and ground processing procedures through which deliverable digital products were realized. The likenesses of the simulation data to the anticipated radiometric and geometric properties of the satellite data are then discussed, and potential discrepancies are outlined. Most primary parameters which were to be simulated were well met. Author

A86-22830

ENSURING A MOSAIC WITH REVISIT FLEXIBILITY CAPACITIES

G. PONCE (CNES, Toulouse, France) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 29-36.

The cross-track viewing capability can be used to increase the number of opportunities to image a precise point and reduce time needed to get a complete mosaic of a vast area. However the problem of ensuring a complete mosaic with all of the images realized on the area becomes more difficult when using this capability, because image strips realized with different viewing angles have different orientations on the ground. The presentation introduces this problem as well as the method used to solve it. The basic organization set up to take into account the solution is described and the method used to choose between all the possible viewing angles for a given orbital pass is also depicted. Author

A86-22851
DIGITAL TERRAIN MODEL SYNTHESIS USING SIGNAL MATCHING IN NATURALLY VEGETATED REGIONS
R. R. IRISH, A. H. STRAHLER (Hunter College, New York), and A. ABIODUM (United Nations, Outer Space Affairs Div., New York) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 241-250. refs

Extracting topographic models from digital imagery requires locating all possible conjugate image points in a stereopair. This is usually handled by signal matching - a process by which an array of pixels surrounding a point in one image is sequentially compared to a series of equivalently sized subsets comprising a larger array in the second image. Matching success depends on several factors. These include the array window size and degree of local image contrast caused by viewing geometry and feature reflectance. A simulated SPOT stereopair, collected over a naturally vegetated region and lacking in any major cultural features, is processed by signal matching using array windows of increasing size. Results support the need for an algorithm that dynamically adjusts itself to changing image phenomena. Author

A86-22852
SPOT POTENTIAL FOR LAND USE/LAND COVER CLASSIFICATION IN USING IMAGE ENHANACEMENT AND COMPUTER PROCESSING
J. H. ROEBIG (Tippetts-Abbett-McCarthy-Stratton, New York), E. HARDY, R. BRYANT (Cornell University, Ithaca, NY), and B. GUETTI (New York State, Dept. of Environmental Conservation, Albany) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 251-258. refs

Three principal investigators have tested the ability of SPOT simulation data to provide the LUNR and National Land Use/Land Cover classification systems categories of information. The methods involve: (1) direct interpretation of categories from 1:24,000 scale false color composite print with special consideration for its potential in mapping vegetation and wetlands; (2) examination of a low-cost Diazo process in making negatives from which color composites can be prepared for use in various forms; and (3) computer processing of simulated data using both supervised and unsupervised classification methods on the Earth Resources Data Analysis System. Author

A86-25485
ADAPTIVE BAYESIAN CLASSIFICATION OF MULTISPECTRAL IMAGES OF THE EARTH [ADAPTIVNAIIA BAIESOVSKAIA KLASSIFIKATSIIA MNOGOZONAL'NYKH IZOBRAZHENII POVERKHNOSTI ZEMLI]
A. M. CHIZHEVSKII (Institut Soiuzgiprovodkhoz, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Nov.-Dec. 1985, p. 60-65. In Russian. refs

An adaptive method for the computer-aided classification of multispectral images of the earth's surface is proposed which is based on the division of the decision-making procedure into three levels of increasing complexity. When a decision is made at a lower level, no calculations at a higher level are required. Compared with a conventional Bayesian classifier based on calculated a posteriori probabilities or their logarithms, the proposed method reduces the recognition time requirement by a factor of 2 to 4 with no loss of accuracy. B.J.

A86-25595
HOLOGRAPHIC RECOGNITION DEVICES [GOLOGRAFICHESKIE RASPOZNAIUSHCHIE USTROISTVA]
G. I. VASILENKO and L. M. TSIBULKIN Moscow, Izdatel'stvo Radio i Sviaz', 1985, 312 p. In Russian. refs

After a review of statistical methods of pattern recognition and the principles of optical data processing, the present work examines the use of holography for pattern recognition. Methods for the development of various types of holographic filters are examined along with factors affecting the reliability of pattern recognition by means of holographic correlators. Particular attention is given to the application of holographic recognition devices in such fields as robot technology, hybrid optoelectronic computing, the processing of remote-sensing data, and spacecraft navigation. B.J.

A86-26316
TEXTURAL INFORMATION IN SAR IMAGES
F. T. ULABY, F. KOUYATE (Michigan, University, Ann Arbor), B. BRISCO, and T. H. L. WILLIAMS (Kansas, University, Lawrence) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, March 1986, p. 235-245. refs

Image variance for a given land use category is presently related to individual variances associated with image speckle and target texture by means of a multiplicative model; in it, speckle is treated as a random process governed by signal fading, that is independent of the textural variations associated with scattering property spatial variations in visually uniform 'distributed' targets. Seasat SAR imagery of Oklahoma was used to evaluate the textural autocorrelation function of water, forest, pasture, urban, and cultivated land use categories. It is found that the image contrast and inverse moment second-order statistics furnished a classification accuracy of 88 percent, with only modest spatial resolution degradation. A second study based on SIR-A imagery of five forested regions shows that the use of textural data can improve classification accuracy from 75 to 93 percent. Author

A86-26693
A COEFFICIENT OF AGREEMENT AS A MEASURE OF THEMATIC CLASSIFICATION ACCURACY
G. H. ROSENFIELD and K. FITZPATRICK-LINS (USGS, Reston, VA) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, Feb. 1986, p. 223-227. refs

The use of the Cohen (1960) Kappa coefficient of agreement to measure total map accuracy and the conditional Kappa to measure individual category accuracy is examined. The development of the Kappa coefficient, its variance, and tests for significant differences are reviewed. The classification error matrices for two photointerpreters computed by Congalton and Mead (1983) by applying the Kappa coefficient of agreement are presented. The Kappa coefficient values and variances are calculated for individual categories of the photointerpreters and compared with percent correct values. The accuracy indices of Turk (1979), Hellden (1980), and Short (1982) used to evaluate the individual category accuracy of remote sensing data are described. These methods and percent correct values are compared with conditional Kappa coefficient values; it is observed that the percent correct values overestimate classification accuracy and the accuracy indices underestimate the classification accuracy when compared to Kappa data. I.F.

N86-16698# California Univ., Davis. Signal and Image Processing Lab.
A TUTORIAL ON CREATING A GRID CELL LAND COVER DATA FILE FROM REMOTE SENSING DATA Final Report
G. E. FORD, D. I. MEYER, and V. R. ALGAZI Jun. 1985 78 p
(Contract DACW05-83-C-0112)
(AD-A159365; SIPL-85-4; SIPL-TD-22) Avail: NTIS HC A05/MF A01 CSCL 09B

This document describes the procedures involved in linking a remote sensing system and a spatial data management system. Specifically, it identifies and describes a sequence of steps for the classification of LANDSAT multispectral scanner (MSS) data and the creation of a grid cell land cover data file. The resulting grid cell file can be merged into a Hydrologic Engineering Center (HEC) Spatial Analysis Methodology (SAM) spatial database. The procedures are also applicable to remote sensing data acquired from other sensor systems. The presentation is intended for those who are familiar with the SAM system and the characteristics and potential of remote sensor image data. Author (GRA)

N86-18384# Centre National d'Etudes Spatiales, Toulouse (France).
GEOMETRIC RECTIFICATION AND PHOTOGRAMMETRIC RECONSTRUCTION OF SPOT IMAGES [RECTIFICATION GEOMETRIQUE ET RESTITUTION PHOTOGRAMMETRIQUE DES IMAGES SPOT]
H. GUICHARD *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 229-233 Jun. 1985 In FRENCH
Avail: NTIS HC A12/MF A01

The use of SPOT satellite imagery for mapping is described. The geometric resolution of SPOT images make them suitable for 1:50,000 scale maps. The mathematical modeling of a scene, and the rectification and triangulation procedures are outlined. Tests on a 600 km long segment (10 scenes) show accuracy better than 10 km, compared to ground truth, using 10 reference points. Author (ESA)

N86-18597# Army Engineer Topographic Labs., Fort Belvoir, Va.
THIRD-ORDER CO-OCCURRENCE TEXTURE ANALYSIS APPLIED TO SAMPLES OF HIGH RESOLUTION SYNTHETIC APERTURE RADAR IMAGERY Technical Report, Jan. - Jun. 1984
R. A. HEVENOR Aug. 1985 38 p
(Contract DA PROJ. 4A1-61101-A-91-D)
(AD-A160640; ETL-0396) Avail: NTIS HC A03/MF A01 CSCL 17I

A third-order co-occurrence texture analysis technique was applied to samples of synthetic aperture radar imagery. This technique was applied to four classes of terrain features on selected samples of radar imagery. The four classes considered were forests, cities, agricultural fields, and water. A fracture vector was computed from samples of each class. A linear feature selection technique was applied for dimensionality reduction, and a pseudo-inverse classifier was developed. This classifier was applied to the original training samples as well as to other samples from the same imagery. GRA

N86-19716# Advanced Information and Decision Systems, Mountain View, Calif.
LINEAR FEATURE EXTRACTION FROM RADAR IMAGERY Final Report, 11 Sep. 1984 - 30 Jun. 1985
D. T. LAWTON, J. GLICKSMAN, G. D. CONNER, and R. J. DRAZOVICH Sep. 1985 149 p
(Contract DACW72-84-C-0014)
(AD-A161154; AI/DS-TR-3075-01; ETL-0405) Avail: NTIS HC A07/MF A01 CSCL 17I

This report summarizes a feasibility study performed by AI&DS to determine the requirements for the extraction of linear features such as roads, rivers, and environmental region boundaries from SAR aerial imagery. The effort has involved determining effective processes for extracting such features by algorithm surveys, hand processing sample imagery, and algorithm implementation. This work has provided the necessary basis for the implementation of an intelligent, automated system in Phase 2 of this research. We have designed a general vision system for linear feature extraction which can be generalized to a wide range of SAR (and other sensor) objects, and begun developments of the components of such a system. Author (GRA)

N86-20268# Joint Publications Research Service, Arlington, Va.
DYNAMIC AEROSPACE SENSING (CONTENT, PROBLEMS, FIELD OF APPLICABILITY) Abstract Only
Y. F. KNIZHNIKOV *In its* USSR Report: Space (JPRS-USP-86-001) p 161-162 13 Jan. 1986 Transl. into ENGLISH form Vestnik Moskovskogo Universiteta, Seriya 5: Geografiya (Moscow, USSR), no. 4, Jul. - Aug. 1985 p 7-13
Avail: NTIS HC A03

Dynamic aerospace sensing is defined as a modern methodology for studying temporal dynamics with the use of aerospace methods. Direct and indirect variants are distinguished, being based on use of a series of photographs taken at different times or on use of individual photographs. Direct methods for the most part supply quantitative information on dynamics, its intensity and rate. The spatial and temporal coverage of the phenomena which can be studied using photographs taken at different times is different. Whereas there are virtually no spatial limitations, the duration of the temporal coverage does not exceed the 11 year, or possibly the bruckner cycle of natural changes. The indirect methods make it possible to study the temporal and spatial dynamics in a case when it is reflected in the external appearance of objects which are indicators of dynamics. The interval of temporal analysis is virtually unlimited. The range of features, phenomena and processes whose dynamics can be studied by aerospace methods is extremely broad and the range of scales is from detailed to global. Nevertheless, they are all based on common methodological principles ensuring a comparability of the results. In the different geographic branches, the level and breadth of development of such studies varies at present. They are particularly promising in meteorology, oceanology, glaciology and hydrology, which deal with mobile objects and phenomena. However, the other geographical sciences, especially dealing with the socioeconomic aspects of geography, can profit greatly from application of the method. Another highly important merit of the method is that it can be applied in the prediction of spatial-temporal changes of features, phenomena and processes; it is useful in expert evaluations, extrapolation and modeling. Author

N86-20453# Joint Publications Research Service, Arlington, Va.
CLASSIFICATION OF NATURAL FORMATIONS BASED ON THEIR OPTICAL CHARACTERISTICS USING SMALL VOLUMES OF SAMPLES Abstract Only
N. S. ABRAMOVICH, A. A. KOVALEV, and V. Y. PLYUTA *In its* USSR Report: Space (JPRS-USP-86-002) p 70 10 Feb. 1986 Transl. into ENGLISH from Issledovaniye Zemli Iz Kosmosa (Moscow, USSR), no. 4, Jul. - Aug. 1985 p 105-111 Original language document was announced in IAA as A86-13288
Avail: NTIS HC A05

A computer algorithm has been developed to classify the spectral bands of natural scenes on Earth according to their optical characteristics. The algorithm is written in FORTRAN-IV and can be used in spectral data processing programs requiring small data loads. The spectral classifications of some different types of green vegetable canopies are given in order to illustrate the effectiveness of the algorithm. I.H.

N86-21972# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Fernerkundung.
INVESTIGATION OF THE INFORMATION CONTENT OF LANDSAT THEMATIC MAPPER (TM) AND SPOT MULTIBAND IMAGE DATA USING SIMULATED IMAGE DATA OF THE FREIBURG REGION
W. KIRCHHOF, W. MAUSER (Freiburg Univ., West Germany), and H. J. STIEBIG (Freiburg Univ., West Germany) Jun. 1985 146 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-975) Original contains color illustrations
(DFVLR-FB-85-49; ISSN-0171-1342) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 52

A comparative analysis of information content was performed using data sets with pixel sizes of 10, 20, 30, 50, and 80 m from LANDSAT TM simulation. The discrimination of objects, structures, and texture, depending on pixel size and combination of spectral bands, was investigated by visual interpretation and supervised classification for applications in agriculture and forestry. The new TM bands produce significant improvements in the separation of vegetated and built-up areas as well as in the delineation of the status of growth and humidity in comparison with LANDSAT MSS. The thematic mapper is eminently suited for the extraction of thematic information of surface areas of 1 hectare or more. Three to four spectral bands are normally sufficient. The information content of 20 m SPOT multiband data does not differ essentially from that of comparable TM bands (TM2, TM3, TM4). A substantial complement to the TM information are structure and texture elements of the panchromatic 10 m SPOT band. Author (ESA)

08

INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A86-19476
REMOTE SENSING; PROCEEDINGS OF THE MEETING, ARLINGTON, VA, MAY 1, 2, 1984
P. N. SLATER, ED. (Arizona, University, Tucson) Meeting sponsored by SPIE - The International Society for Optical Engineering and ASP. Bellingham, WA, SPIE - The International Society for Optical Engineering (SPIE Proceedings. Volume 475), 1984, 159 p. For individual items see A86-19477 to A86-19489. (SPIE-475)

The subjects investigated are related to modeling studies, Atmospheric effects and radiometric calibration, marine and geological research, spectral signature studies, agricultural research, information extraction and processing, engineering and mapping considerations, and future prospects. Attention is given to a review of models and measurements of multispectral reflectance by plant canopies with recommendations for future research, electrooptical terrain reflectance modeling, atmospheric effects on remote sensing of surface reflectance, the importance and attainment of accurate absolute radiometric calibration, remote sensing of coastal and ocean properties, and high spectral resolution remote sensing of the land. The remote sensing of vegetation at regional scales is considered along with the remote sensing of vegetation characteristics for farm management, the interpretation of topographic relief from digital multispectral imagery, remote sensing research, mapping the earth from space in the 1980s, and the future of remote sensing according to a viewpoint from industry. G.R.

A86-19480* Arizona Univ., Tucson.
THE IMPORTANCE AND ATTAINMENT OF ACCURATE ABSOLUTE RADIOMETRIC CALIBRATION
P. N. SLATER (Arizona, University, Tucson) IN: Remote sensing; Proceedings of the Meeting, Arlington, VA, May 1, 2, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 34-40. refs
(Contract NAG5-196; USDA-12-14-5001-38)

The importance of accurate absolute radiometric calibration is discussed by reference to the needs of those wishing to validate or use models describing the interaction of electromagnetic radiation with the atmosphere and earth surface features. The in-flight calibration methods used for the Landsat Thematic Mapper (TM) and the Systeme Probatoire d'Observation de la Terre, Haute Resolution visible (SPOT/HRV) systems are described and their limitations discussed. The questionable stability of in-flight absolute calibration methods suggests the use of a radiative transfer program to predict the apparent radiance, at the entrance pupil of the sensor, of a ground site of measured reflectance imaged through a well characterized atmosphere. The uncertainties of such a method are discussed. Author

A86-19491* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MULTIBAND SELECTION DEVICE
H. L. RICHARD (NASA, Goddard Space Flight Center, Greenbelt, MD), A. M. MIKA, and R. O. DAVIS (Santa Barbara Research Center, Goleta, CA) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 2-8. refs

Current science projections for future earth-imaging instruments indicate the need for as many as 25 spectral bands, with bandwidths as narrow as 20 nanometers. The desire for a multiplicity of bands has led researchers to study various spectrally dispersive instrument designs as a means of providing the desired future capability. These instrument designs, however, are costly, complex, and of high technical risk. This paper describes a 'multiband selection device' containing several spectral filters that can be placed at the exit faces of a broadband multiport beam splitter and thereby provide a multiplicity of spectral bands with a high degree of spatial coregistration while utilizing state-of-the-art linear array detectors. Fabrication of the multiband selection device has been successfully accomplished, and the design and test results are described. Author

A86-19492* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE LINEAR ARRAY MULTI-BAND SELECTION DEVICE ROLE IN REMOTE-SENSING INSTRUMENT DESIGN
E. E. SPEAKER (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 9-12.
(Contract NAS5-27173)

A figure-of-merit parameter for the scientific utility of multispectral linear array (MLA) instruments for civil remote sensing is presented. The number of spectral band-pair choices available to the user of a given MLA instrument is proposed as a useful measure of the flexibility and overall utility of that particular instrument design. The multiband selection device capability is analyzed mathematically, and a basis for a cost-benefit comparison of alternative multispectral instrument designs is provided. B.J.

A86-19493* Santa Barbara Research Center, Goleta, Calif.
OPTICAL-SYSTEM DESIGN FOR NEXT-GENERATION PUSHBROOM SENSORS
A. M. MIKA (Santa Barbara Research Center, Goleta, CA) and H. L. RICHARD (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 13-23. refs

Next-generation pushbroom sensors for earth observation require high-performance optics that provide high spatial resolution over wide fields of view. Specifically, blur diameters on the order of 10 to 15 microns are needed over 5 to 15 deg fields. In addition to this fundamental level of optical performance, other characteristics, such as spatial coregistration of spectral bands, flat focal plane, telecentricity, and workable pupil location are significant instrument design considerations. The detector-assembly design, optical line-of-sight pointing method and sensor packaging all hinge on these secondary attributes. Moreover, the need for broad spectral coverage, ranging from 0.4 to 12.5 microns, places an additional constraint on optical design. This paper presents alternative design forms that are candidates for wide-field pushbroom sensors, and discusses the instrument-design tradeoffs that are linked to the selection of these alternate optical approaches. Author

A86-19494* RCA Advanced Technology Labs., Camden, N. J.

VISIBLE AND SHORTWAVE INFRARED FOCAL PLANES FOR REMOTE SENSING INSTRUMENTS

J. R. TOWER, B. M. MCCARTHY, L. E. PELLON, R. T. STRONG (RCA Advanced Technology Laboratories, Camden, NJ), H. ELABD (RCA Laboratories, Princeton, NJ) et al. IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 24-33. NASA-supported research. refs

The development of solid-state sensor technology for multispectral linear array (MLA) instruments is described. A buttable four-spectral-band linear-format CCD and a buttable two-spectral band linear-format short-wave IR CCD have been designed, and first samples have been demonstrated. In addition, first-sample four-band interference filters have been fabricated, and hybrid packaging technology is being developed. Based on this development work, the design and construction of focal planes for a Shuttle sortie MLA instrument have begun. This work involves a visible and near-IR focal plane with 2048 pixels x 4 spectral bands and a short-wave IR focal plane with 1024 pixels x 2 spectral bands. B.J.

A86-19502

USE OF SATELLITE DATA IN OPERATIONAL NUMERICAL WEATHER PREDICTION

R. E. KISTLER and R. D. MCPHERSON (NOAA, National Meteorological Center, Washington, DC) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 92-99. refs

The place of remotely sensed data in the historical perspective of the evolution of operational numerical weather prediction since its inception in 1955 is described. This is followed by a discussion of the remotely sensed components of the global data base in terms of the number of reports from each source, their distribution and availability, and their characteristics and error structure. In addition, an optimum interpolation objective analysis method is developed with emphasis on the treatment of remotely sensed data. Finally, challenges posed by new observing systems are considered. B.J.

A86-19503

REAL TIME METEOROLOGICAL APPLICATIONS OF THE GEOSTATIONARY SATELLITE SOUNDER ON GOES-6 - BATTLING THE COMPUTER, CODE AND CLOCK

C. M. HAYDEN (NOAA, National Environmental Satellite, Data, and Information Service, Madison, WI) and A. J. SCHREINER (NOAA, Space Science and Engineering Center, Madison, WI) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 100-107. refs

From the beginning of December 1983 through mid-February 1984 the Cooperative Institute for Meteorological Satellite Studies (CIMSS) carried out an exercise to deliver temperature and moisture profiles, derived from the GOES-6 VISSR Atmospheric Sounder (VAS), to the National Meteorological Center (NMC) in time for input to the operational forecast at 1330 GMT. The purpose was to provide meteorological data coverage over the data sparse eastern Pacific (EPAC) where timely polar orbiting satellite data are not available. Although a product was delivered only 40 percent of the time, the experiment successfully demonstrated the feasibility of a totally automated VAS retrieval procedure. Data reliability achieved at the EPAC scale appears to be good, though lack of independent verification data requires that forecast impact studies delineate their ultimate value. Author

A86-19504* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

REVIEW OF EXPERIMENTS ON THE IMPACT OF SATELLITE DATA ON NUMERICAL WEATHER PREDICTION

R. ATLAS, E. KALNAY, and M. HALEM (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 108-115. refs

A brief review is presented of simulation studies and real data experiments which were conducted to assess the impact of satellite observations on numerical weather prediction. These experiments show that while there has been some redundancy between observing systems, satellite data has made significant contributions toward improving global forecasting. Author

A86-19505

RESULTS OF EXPERIMENTAL NUMERICAL FORECASTS USING TEMPERATURE PROFILES FROM GEOSTATIONARY SATELLITES

E. A. OLENIC (NOAA, National Meteorological Center, Washington, DC) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 116-121. refs

A86-19507

WINDSAT - A CONCEPT FOR GLOBAL WIND MEASUREMENT BY INFRARED DOPPLER LIDAR

R. M. HUFFAKER and F. F. HALL, JR. (NOAA, Wave Propagation Laboratory, Boulder, CO) IN: Recent advances in civil space remote sensing; Proceedings of the Meeting, Arlington, VA, May 3, 4, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 129-140. refs

A detailed computer simulation of the Windsat global wind measuring process has been developed and used to establish error limits as a function of design parameters. Studies were conducted for a Windsat research system in a 300 km and an 800 km orbit. Wind measuring errors were less than 2 m/s in the troposphere for the recommended set of parameters. The results indicate the feasibility of measuring global winds from a space platform using a Doppler laser radar. Author

A86-19545

OPTICAL PAYLOAD ACCOMMODATION ON A SPACE STATION

F. C. RUNGE (McDonnell Douglas Astronautics Co., Huntington Beach, CA) IN: The National Symposium and Workshop on Optical Platforms, Huntsville, AL, June 12-14, 1984, Proceedings . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 204-211.

Installation accommondation being planned for the Space Station for the exterior and interior payload equipment and operations are studied. The use of the Space Station for support of earth/ocean/atmospheric instrument technology is examined. An example of large deployable telescope assembly and extravehicular activities technology developments is presented. The function, equipment, and internal and external accommodations of the Space Station for the space infrared telescope, which is a one-meter class, cryogenically cooleid instrument, are described. The development of an advanced X-ray astrophysics facility for X-ray astronomy research is discussed. The utilization of the Space Station for storgae and assembly of a 20-m diameter, multimirror telescope with detector in the infrared and submillimter range is analyzed. I.F.

A86-20456* Georgia Inst. of Tech., Atlanta.

A TWO-PHOTON LASER-INDUCED FLUORESCENCE FIELD INSTRUMENT FOR GROUND-BASED AND AIRBORNE MEASUREMENTS OF ATMOSPHERIC NO

J. D. BRADSHAW, M. O. RODGERS, S. T. SANDHOLM, S. KESHENG, and D. D. DAVIS (Georgia Institute of Technology, Atlanta) Journal of Geophysical Research (ISSN 0148-0227), vol. 90, Dec. 20, 1985, p. 12,861-12,873. Research supported by the Coordinating Research Council. refs
(Contract NAG1-50)

This paper reports on a new two-photon laser-induced fluorescence (TP-LIF) sensor capable of making routine measurements at the few parts per trillion volume level. This direct spectroscopic detection method has been demonstrated to be a reliable instrument while performing both on the ground and in the air. As currently designed it is unique in being 'signal' rather than 'signal-to-noise' limited. The latter characteristic enables the TP-LIF sensor to make atmospheric measurements of NO under environmental conditions that might normally be considered unsuitable for a laser technique. These include clouds, rain, and, in general, high-atmospheric-aerosol loading conditions. Of special interest is the insensitivity of the TP-LIF NO instrument to changes in pressure while operating in the troposphere. This characteristic has enabled this sensor to be used to record real-time altitude profiles of NO. Future improvements should make possible two measurement opportunities: (1) NO flux measurements via the airborne eddy-correlation method and (2) nitrogen isotopic distribution measurements (e.g., (N-15)(O-16) versus (N-14)(O-16) as a means of identifying specific NO(x) sources. Author

A86-20694

DIGITAL IMAGE DISPLAY AND ANALYSIS OF POLAR ORBITING METEOROLOGICAL SATELLITE AVHRR DATA

W. D. MCFARLAND, T. HOTRABHAVANANDA, M. LYON, S. CHEN, and T. W. BARNEY (Missouri-Columbia, University, Columbia) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 341-345. NOAA-supported research. refs

The Geographic Resources Center (GRC), University of Missouri-Columbia, working in cooperation with the National Oceanic and Atmospheric Administration (NOAA) Assessment and Information Service Center (AISC) has developed display and analysis capabilities for the NOAA-n Meteorological Satellite (Metsat) series of polar orbiting satellites. This research utilizes the Advanced Very High Resolution Radiometer (AVHRR) scanner which was placed on board the later Metsat. Vegetation indices based on various combinations of channels 1 and 2 from the AVHRR show promise for global vegetation monitoring. A data base from April 1982, to the present has been generated of daily and weekly composite image data in a polar stereographic projection (PSG). These data are received weekly at the GRC and processed for quantitative statistics from target areas and for image display. Both RGB and IHS color display formats are used. Quantitative analysis and graphical display of statistics in the form of time series plots has shown promising results. Even at this low spatial resolution the ability to monitor and characterize vegetative stress has been shown. Author

A86-20703* Maryland Univ., College Park.

AN INTERACTIVE TECHNIQUE TO GENERATE DIGITAL ELEVATION DATA USING A VIDICON CAMERA

J. K. SIRCAR and R. M. RAGAN (Maryland, University, College Park) IN: Spatial information technologies for remote sensing today and tomorrow; Proceedings of the Ninth Pecora Symposium, Sioux Falls, SD, October 2-4, 1984 . Silver Spring, MD, Institute of Electrical and Electronics Engineers, Inc., 1984, p. 411-418. NASA-USDA-supported research. refs

A technique is proposed for the semi-automatic digitization of topographic maps using a vidicon camera interfaced with a mini-computer system. The required input is a black and white map that shows only contour lines and corresponding elevation values such as the advance prints of 7.5 minute USGS topographic sheets. A set of image processing algorithms is implemented on an image of the contour map acquired by a vidicon camera. The system developed performs extraction of contour lines, tagging elevation values and subsequent interpolation of elevations to produce, in 5 sec. x 5 sec. intervals of latitude and longitude, digital elevation matrices. The interpolation of elevations for non-contour points is achieved using a steepest descent algorithm. A communications capability allows the final data to be transferred over telephone lines to an off-site unit such as the floppy disk or a micro-computer. Author

A86-21102#

METHODS AND RESULTS OF SPOT SIMULATION STUDIES - AN OVERVIEW [METHODES ET RESULTATS DES SIMULATIONS SPOT - VUE D'ENSEMBLE]

J. L. DIZIER and J. C. FAVARD (Groupement pour le Developpement de la Teledetection Aerospatiale, Toulouse, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1-15. In French.

The SPOT simulation studies were initiated in 1979, and they are terminated in 1984/85. A description is given of the techniques which are utilized to simulate the images that will be provided by the future satellite. In the simulation operations, use is made of a 10-channel Daedalus scanner which is carried by an aircraft, taking into account flights at altitudes of 3,500 m and 7,000 m. Details regarding the objectives of the simulation program and the involved test sites are considered. The subjects explored are related to geology, mining prospection, cartography, agriculture, land use, forestry, the coastal zone, urban planning, irrigation, rice production forecast, geomorphology, floods and water regulation, the integrated study of a natural area, grazing ranching management, rice cultivation, and coastal sedimentation. The test sites studied are located in France, Senegal, Mali, Niger, Burkina-Faso, Bangladesh, England, Greece, Italy, Germany, Belgium, U.S., Sudan, Kenya, and Zimbabwe. G.R.

A86-21103#

STUDY OF THE SPOT SIMULATIONS OVER WEST AFRICA

A. BERG (CEC, Joint Research Centre, Ispra, Italy) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 17-25. refs

An airborne SPOT simulation campaign was organized at the end of 1981 over four Sahelian countries in West Africa. The 19 simulation flights covered five different themes related to the main problems which confront SAHEL at the present time. These these are Land Use and Desertification - Agricultural Resources - Urban Planning - Coastal Environments - Geology and Mineral Resources. The investigation results are summarized and conclusions are drawn about the value of second generation satellites, in this case SPOT, for the future development of remote sensing applications for developing countries. Author

A86-21109*# General Electric Co., Philadelphia, Pa.

GEOMETRIC CORRECTION OF LANDSAT 4 AND 5 THEMATIC MAPPER DATA

E. P. BEYER (GE Valley Forge Space Center, Philadelphia, PA), J. BROOKS (General Electric Co., Space Div., Lanham, MD), and V. V. SALOMONSON (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 89-100. refs

Landsat-4 was launched on July 16, 1982, while the launch of Landsat-5 took place on March 1, 1984. The earth-observing instruments employed were the Multispectral Scanner (MSS), which has flown since 1972 on Landsat satellites, and the Thematic Mapper (TM). The TM provides improved spatial radiance and spectral resolution. The improved capabilities of the TM, the use of different scanning mechanisms relative to the MSS, and the use of a new spacecraft with different mechanical operating characteristics led to a significant challenge in processing the TM and MSS data. The current paper has mainly the objective to present recent results which can provide information regarding the quality of processing as measured against specifications. The results obtained so far for the Thematic Mapper Image Processing System (TIPS), though limited, are found to be quite encouraging as far as the geometric processing of the TM is concerned. G.R.

A86-21113#

REPORT ON AN ORBITAL MAPPING SYSTEM

A. P. COLVOCORESSES (U.S. Geological Survey, National Center, Reston, VA) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 139-143. refs

During June 1984, the International Society for Photogrammetry and Remote Sensing accepted a committee report that defines an Orbital Mapping System (OMS) to follow Landsat and other earth-sensing systems. The OMS involves the same orbital parameters of Landsats 1, 2, and 3, three wave bands (two in the visible and one in the near infrared) and continuous stereoscopic capability. The sensors (3) involve solid-state linear arrays and data acquisition (including stereo) designed for one-dimensional data processing. It has a resolution capability of 10-m pixels and is capable of producing 1:50,000-scale image maps with 20-m contours. In addition to mapping, the system is designed to monitor the works of man as well as nature and in a cost-effective manner. Author

A86-21115#

MOS-1 AND ERS-1

T. IGARASHI (National Space Development Agency of Japan, Tokyo) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 167-186.

On 9 August 1984, the Space Activities Commission of Japan decided the policy to estimate the budget for the development of Earth Resources Satellite No. 1, according to this policy, Science and Technology Agency and Ministry of International Trade and Industry are seeking the approvement for the new start of the design and development phases of ERS-1. Meanwhile, Marine Observation Satellite No. 1 is underway in manufacturing and test phases. This paper describes Japan's MOS-1 and ERS-1 program, their status, planning and objectives and provides a description of space segments and ground segments. Author

A86-21117#

CANADA'S SYNTHETIC APERTURE RADAR SATELLITE

E. J. LANGHAM, E. SHAW, and R. K. RANEY (Canada Centre for Remote Sensing, Ottawa) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 191-199.

The developmental history of Canadian synthetic aperture radar satellite for Arctic resource monitoring, RADARSAT, is given. The criteria used to establish hardware electronics requirements for the RADARSAT spacecraft, the radar, and the ground segment of the system are discussed. The main applications of RADARSAT data are described, including: daily monitoring of changes in the structural characteristics of ice masses; wave monitoring; and oil exploration. A schematic diagram of the RADARSAT on-orbit configuration is provided. I.H.

A86-21135#

THE REMOTE SENSING SATELLITE PROGRAM OF JAPAN

T. IGARASHI (National Space Development Agency of Japan, Tokyo) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 399-408.

The remote-sensing satellite program of Japan is described, with special reference to the aspects of its commercial operations. Three projects are discussed: (1) the MOS-1 project (its satellite to be launched in summer 1986), which is to establish the mission performance of the earth observation system (MOS-1 satellite and ground segment) and the usefulness of MOS-1 data for the user community; (2) the ERS-1 project (to be launched in 1990), the main purposes of which are to establish the earth observation techniques of microwave sensors and to explore the earth's nonrenewable resources, as well as to monitor land use, environment preservation, prevention of disasters, and coastal zone changes; and (3) the Earth Observation Satellite Application project, which includes the establishment of the ground station for earth observation satellites and operation and processing of Landsat, MOS-1, and other satellite data. Results of marketing research on the Landsat data sales and distributions are included. I.S.

A86-21136#

FUTURE SATELLITE EARTH OBSERVATION GROUND SYSTEMS

T. IGARASHI, K. ARAKI, T. GOKA, Y. ISHIDO, and M. KOJIMA (National Space Development Agency of Japan, Tokyo) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 419-433.

MSS and TM data from Landsat 5 are now received and processed at the Earth Observation Center (EOC) of NASDA which is located in the middle part of the Saitama Prefecture approximately 50 km away from Tokyo. MOS-1 (Marine Observation Satellite-1), the first Japanese earth observation satellite, is now under development with a launch target in 1986. Four mission payloads, Multispectral Electric Self Scanning Radiometer (MESSR), Visible and Thermal Infrared Radiometer (VTIR), Microwave Scanning Radiometer (MSR), and Data Collection System (DCS), are installed on MOS-1. Data acquisition, processing, and mission control systems will be installed in EOC. The system requirements and configuration of MOS-1 ground systems are reported. Author

A86-21138#

EVALUATION OF MOS-1 MICROWAVE SCANNING RADIOMETER (MSR) DATA IN FIELD EXPERIMENTS

K. ARAI, T. IGARASHI, C. ISHIDA, H. WAKABAYASHI, and Y. TAKAGI (National Space Development Agency of Japan, Tokyo) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 435-444.

The Microwave Scanning Radiometer (MSR) is an imaging 2-frequency radiometer that will be flown on the first Japanese remote sensing satellite, MOS-1 in 1986. In order to evaluate the sensor parameters and to establish the basic data processing algorithms, NASDA has carried out field experiments and data analysis with three cooperative institutes from 1981 to 1984. This paper presents the early results from one phase of research carried out for the measurement of snowpack properties, atmospheric water vapor content, cloud liquid content, and sea-surface wind velocity. Author

A86-21151#
RESULTS AND FUTURE ASPECTS OF CO2-LASER SYSTEMS IN REMOTE SENSING

F. LEHMANN (Muenchen, Universitaet, Munich, West Germany), W. WIESEMANN (Battelle-Institut, Frankfurt am Main, West Germany), and C. WERNER (DFVLR, Munich, West Germany) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 555-562. BMTF-supported research. refs

The application possibilities of MID-IR laser spectroscopy to remote sensing were investigated in laboratory work and flight campaigns. For the flight measurements, the DIALEX instrument, a profiling laser spectrometer with two tunable CO2-lasers was used. The lasers are tunable on about 60 lines (bandwidth about 10 to the -5th microns) from 9 to 11 microns in the thermal infrared region. Due to the very low power of the received laser radiation, the system is working with heterodyne detection. In the laboratory, the reflection spectra of minerals, soils, rocks, vegetation, water, moistured surfaces and oil spills on water were taken. Most of the soil- and rockforming minerals (especially the silicates) show characteristic spectral signatures in the MID-IR, where Reststrahlenbands occur. Using four laser lines, it is possible to detect soil- and rock types. With increasing surface moisture content, the spectral signature of a surface is turning to the spectral signature of pure water. Oil spills and vegetation are showing broad spectral signatures too in the measuring range. The data of the flight measurements (soil-, rock surfaces, water, irrigated field, vegetation, asphalt) are in good agreement with the corresponding laboratory results (in-situ measurements). The mean deviation between these data is about + or - 15 percent. Based on these results, a program was started for the development of a multisensor active and passive system combining a near-infrared-multispectral-scanner with a CO2-laser-scanner. Author

A86-21158#
HIGH RELIEF TERRAIN CLASSIFICATION USING DIGITAL ELEVATION MODEL VARIABLES AND LANDSAT MSS DATA IN THE YUKON TERRITORY, CANADA

S. E. FRANKLIN and E. F. LEDREW (Waterloo, University, Canada) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 603-611. Research supported by the Department of Indian Affairs and Northern Development. refs
(Contract NSERC-A-8454)

A86-21163#
DEVELOPMENT OF AN AIRBORNE CCD SCANNER FOR LAND AND SEA APPLICATIONS

N. J. J. BUNNIK, H. POUWELS, L. AARTMAN, P. BINNENKADE (Nationaal Lucht- en Ruimtevaartlaboratorium, Amsterdam, Netherlands), C. SMORENBURG (Centrale Organisatie voor Toegepast-Natuurwetenschappelijk Onderzoek, Technisch Physische Dienst TNO, Delft, Netherlands) et al. IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 713-721.

An airborne multispectral scanner based on the use of CCD detector arrays has been developed. The device is known as CAESAR (CCD Airborne Experimental Scanner for Applications in Remote sensing). The CAESAR project has mainly the objective to increase Dutch experience with respect to the application of CCD detectors for earth observation, giving particular attention to the exploration of the technical problem areas associated with the use of CCD detectors. A second objective is related to the stimulation of application-oriented research in the use of multispectral data for land and sea observation by means of a versatile system specified by existing user requirements. After the development and test phase, the project will be continued with an application-oriented evaluation phase to be executed in 1985. The present article provides a description of the user specifications, the design of the sensor system, and the onboard data handling system. Attention is given to the first results of flight tests conducted in July 1984. G.R.

A86-21164#
LINEAR CHARGE-COUPLED DEVICE DETECTOR FOR MULTISPECTRUM CAMERA

J. CHABBAL, F. CAPECCHI, and B. POULIQUEN (Thomson-CSF, Division Tubes Electroniques, Boulogne-Billancourt, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 723-732.

It is pointed out that the new generation of earth resources survey satellites, such as the French satellite SPOT, employs a pushbroom multispectral imaging system. Such a system provides a number of fundamental improvements over an optomechanical scanned system. These improvements are related to the absence of a scanning mirror, an increased integration time and signal to noise ratio, improved resolution, and offset pointing capability. The present paper is concerned with development work which is to provide linear CCD detectors for use in a pushbroom multispectral instrument, taking into account an employment in the SPOT II instrument. A description is given to the linear CCD detector TH 7801A. Attention is also given to the photoelement structure, design considerations for the output stage, the TH 7801A electrical characteristics, wafer technology, fabrication technology, and approaches to obtain CCDs for high reliability applications. G.R.

A86-21167#
CAPABILITY OF INDIAN SATELLITE BHASKARA TV-DATA TO IDENTIFY LAND FEATURES

K. S. RAO, S. B. N. RAO, A. NIZAM, B. K. MOHAN, A. SOWMYA (Indian Institute of Technology, Bombay, India) et al. IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 759-763.

Bhaskara-II represents one of the experimental satellites which were placed in orbit by India in November 1981. The satellite was launched with the objective to conduct remote sensing operations on the basis of a utilization of a TV camera and microwave radiometers. The employed cameras operate in two spectral bands, including the visible region (0.54-0.66 microns) and the near-infrared region (0.75-0.85 microns). The present paper is concerned with studies that were to determine which land features could be observed with a reasonable amount of clarity. The scene selected for these studies included the Bombay city area, which contains certain easily identifiable features. There are three major lakes in the city, while a river flows in the northern part of the city. Attention is given to the digital preprocessing of Bhaskara image data, and a data analysis. On account of the low resolution, only broad land features could be identified. G.R.

A86-21179#
HRV SPOT CAMERA DETECTION UNIT - OPTICAL AND RADIOMETRIC CHARACTERISTICS

G. CORLAY, C. HENRY, and J. B. PAUL (Societe d'Etudes et de Realisations Nucleaires, Limeil-Brevannes, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 941-955.

The main features of the detection unit for the High Resolution Visible (HRV) push-broom cameras of the SPOT observation satellite are summarized. Operating from a 830-km high orbit, the cameras will view a strip of the earth 60 km wide with a 10-m resolution. The main functions of the detection unit are to convert optical signals into electronic signals, to separate the four spectral bands, and to constitute 6000-pixel detection lines. The main optical and radiometric characteristics are presented: spectral sensitivity, responsivity and spatial uniformity, signal to noise ratio, modulation transfer function, and geometric characteristics related to image quality. The first flight models have been tested and delivered, and test results give confidence that flight performance will be as required. D.H.

A86-21182#

SURFACE TEMPERATURE AND EMISSIVITY EVALUATION FROM SATELLITE THERMAL INFRARED MEASUREMENTS

C. ULIVIERI (Roma, Universita, Rome, Italy), G. CANNIZZARO, and M. RICOTTILLI (Telespazio S.p.A., Rome, Italy) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 989-999. refs

The paper presents some considerations on surface temperature and emissivity assessment by single and multichannel thermal infrared approaches. AVHRR/NOAA-7 measurements have been simulated at 3.7 and 10.5 micron wavelengths; in particular LOWTRAN 5 Code has been used to compute atmospheric transmittance in several typical cloud-free atmospheric conditions. A parametric study has been carried out to estimate the most suitable approaches in terms of accuracy on retrieved surface temperatures and emissivities. They are related to NOAA measurements by corrective functions depending upon all the environmental parameters. Author

A86-21201#

SELF-CALIBRATION METHOD OF THE MICROWAVE RADIOMETER USING TWO TEMPERATURE REFERENCES

N. ZENG, H. ZHANG, and D. REN (Shanghai Research Institute of Microwave Technology, People's Republic of China) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1227-1235.

To minimize the effect of gain fluctuations on the performance of Hach's radiometer and increase its long-term stability and reliability, a self-calibration method is proposed that uses the same internal temperature references. The calibration method could be performed almost without interrupting temperature measurements at any time during remote sensing operations. It is shown that the method is a convenient way to improve the stability of Hach's radiometer without adding expensive components. D.H.

A86-21208#

FLEXIBLE MULTISPECTRAL LINEAR ARRAY (MLA) SENSORS FOR LANDSAT APPLICATIONS

A. M. MIKA (Hughes Aircraft Research Center, Santa Barbara, CA) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1321-1330.

The application of large-scale-integrated (LSI) circuit technology to detector arrays has provided a basis for the implementation of the MLA instrument concept. It is now feasible to produce a sensor utilizing high-density linear detector arrays which obviate the need for a scanning mechanism. The MLA concept is discussed, taking into account MLA operation, MLA imaging modes, cross-track pointing geometry, and imaging probability vs time for events of opportunity. The MLA sensor will provide significant improvements in spatial, spectral, and radiometric resolution, coupled with extraordinary flexibility in on-orbit spectral-band selection. Attention is given to the three-element telescope design, an MLA instrument design summary, the structural design, and future variants. G.R.

A86-21227*# Environmental Research Inst. of Michigan, Ann Arbor.

ABSOLUTE CALIBRATION FOR SAR SYSTEMS

P. L. JACKSON, R. W. LARSON, and R. M. MAJEWSKI (Michigan, Environmental Research Institute, Radar Div., Ann Arbor) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1527-1532. NASA-supported research. refs

Absolute calibration of synthetic aperture radar data is desirable for space and time continuity in earth resource investigations. For this purpose, a calibration signal is used to compare data from a calibration flight, during which precision reflectors are imaged, to data from subsequent SAR flights. The calibration signal duplicates the SAR response from a point source. This signal is amplified and converted by the radar system and processed in precisely the same way as data. Author

A86-21248#

A SYNTHETIC APERTURE RADAR (SAR) FOR COMMERCIAL APPLICATIONS

B. L. BULLOCK (Intera Technologies, Ltd., Calgary, Canada) and A. KOZMA (Michigan, Environmental Research Institute, Ann Arbor) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1733-1742. refs

Studies leading to the design specifications and subsequent development of a SAR built solely for commercial applications are described. Background searches were made of potential users and their requirements and the corresponding technology. The system developed is called STAR 1 (for Sea-Ice and Terrain Assessment Radar); it is an X-band system installed in a light turboprop aircraft. The data are digitally processed in real time aboard the aircraft and the image is telemetered to a ground station for immediate use. The system is currently operational and has performed a number of tasks including support of arctic drilling and engineering, iceberg detection, arctic transportation, and terrain surveys. D.H.

A86-21249*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE EFFECTS OF SENSOR ADVANCEMENTS ON THEMATIC MAPPER DATA CLASSIFICATION

J. R. IRONS, B. L. MARKHAM, R. F. NELSON, D. L. TOLL, D. L. WILLIAMS (NASA, Goddard Space Flight Center, Greenbelt, MD) et al. IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1759-1773. refs

Analyses of Landsat Thematic Mapper (TM) data were conducted to assess the effects of sensor advancements on the thematic classification of remote sensing data. The effects of altering three sensor characteristics (spatial resolution, data quantization, and spectral band configuration) from Landsat Multispectral Scanner (MSS) specifications were investigated using analysis-of-variance (ANOVA). Analyses were conducted on data from two TM scenes: Washington, D.C. (late autumn) and western Pennsylvania (late summer). Results indicate that the contribution of sensor advancements to thematic classification are highly dependent of spectral and spatial scene attributes. D.H.

A86-21256#

EMPIRICAL STUDIES OF THE RELATIONSHIP BETWEEN LANDSAT MSS-DATA AND TOPOGRAPHY

K. HALL and L. OLSSON (Lunds Universitet, Lund, Sweden) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 3 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 1835-1844. refs

The study consists of an investigation of the influence of topography on Landsat MSS - data. A digital terrain model was created and data on slope gradient and aspect were derived and superimposed on the Landsat image. Areas of known homogeneous land cover were studied concerning pixel values and slope gradient and aspect. Although being rather ambiguous results indicate a certain influence of topography on pixel values. This is most obvious for MSS 6 and MSS 7. Band ratioing had no reducing effect. Slope gradients lower than 10 degrees were not found to be affected by the topography. Author

A86-21899*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

PREDICTING EARTH'S DYNAMIC CHANGES

S. I. RASOOL (California Institute of Technology, Jet Propulsion Laboratory, Pasadena; CNRS, Laboratoire de Meteorologie Dynamique, Paris, France) Aerospace America (ISSN 0740-722X), vol. 24, Jan. 1986, p. 78-80, 82.

Given a suitable strategy for conducting measurements, satellite-based remote sensing of the earth can furnish valuable information on the dynamic changes of such planetary characteristics as ocean surface temperatures and atmospheric CO2. Observations must be global and synoptic, quantitatively validated, and consistent over the long term. A program spanning 20 years will study such critical variables as solar flux, stratospheric temperature, aerosols and ozone, cloud cover, tropospheric gases and aerosols, radiation balance, surface temperature, albedo, precipitation, vegetation cover, moisture, snow and ice, as well as oceanic color, topography, and wind stress. O.C.

A86-22271

IMPROVING YOUR IMAGE

G. BRACHET (SPOT Image Corp., Washington, DC) Space (ISSN 0267-954X), vol. 1, Dec. 1985-Feb. 1986, p. 30-33.

The design characteristics of the Spot spacecraft are described. The Spot spacecraft carries two sensors called HRVs (Haute Resolution Visible) which consist of solid state detector arrays operating in the optical and near infrared regions of the spectrum. Each HRV has a swathwidth of 60 km and can be operated independently. Observations are made in three spectral bands with a pixel size of 20 meters. The three bands include: a green band from 0.50 microns to 0.59 microns; a red band from 0.61 microns to 0.68 microns; and a near infrared band from 0.69 microns to 0.89 microns. A streerable mirror on the Spot spacecraft provides off-nadir viewing capability, allowing scene centers to targeted anywhere within a 950-km-wide strip centered on the satellite track. The ground receiving stations in the spot data distribution network are located in France and northern Sweden. The contractual arrangements between users and the private organization running the Spot program, SPOT IMAGE, are described in detail. I.H.

A86-22826

SPOT SYSTEM CONCEPTION AND PROGRAM STATUS

M. COURTOIS (CNES, Toulouse, France) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 8-18.

In February 1978, France, Belgium, and Sweden decided to undertake the development of an experimental earth observation system, called SPOT. The term 'SPOT' represents an acronym for the French name of the system. The space segment of the SPOT system consists of two parts, including the platform and the mission specific payload. The ground segment of SPOT contains the ground control segment and the image reception ground segment. The first SPOT spacecraft is currently under development, and it has been decided to produce and launch a second satellite (SPOT 2). Attention is given to the SPOT platform, the SPOT 1 payload, the HRV instruments, the optics and detection system, electronics, the off-nadir viewing mechanism, calibration, the payload telemetry subsystem, payload programming, image reception and processing, image data compatibility, and geometric image quality. G.R.

A86-22831

TESTING SPOT SATELLITE ACQUISITION STRATEGIES OVER THE UNITED STATES

E. S. MEREDITH and G. M. WEILL (SPOT Image Corp., Washington, DC) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 37-44.

The SPOT satellite is a flexible and complex data acquisition system. In view of its various programmable modes and high resolution, SPOT represents an intermediate between a Landsat type satellite and a high-altitude aircraft. It is pointed out that some of the experience gained from the 1983 U.S. SPOT Simulation Campaign can be applied to estimate and optimize the potential throughput of the satellite. The satellite performance was estimated on the basis of three programming strategies. Attention is given to aspects of SPOT orbital parameters and data acquisition, questions of satellite programming simulation, the obtained results, and the relation of the simulation to the actual programming of SPOT. G.R.

A86-22840* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A COMPARATIVE EVALUATION OF SIMULATED SPOT, THEMATIC MAPPER, AND SIMULATED THEMATIC MAPPER DATA IN A WESTERN ECOZONE

J. S. BUIS (NASA, Ames Research Center; Technicolor Government Services, Inc., Moffett Field, CA) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 130-136. refs

Spectral information content was quantitatively measured for simulated SPOT, Thematic Mapper, and simulated Thematic Mapper data acquired over Santa Cruz County, California. Two techniques were employed: spectral separability summarized through optimal wave band evaluation, and histogram cluster analysis. Using data from the three sources it is shown that three spectral bands can provide separability nearly as high as six bands provide, if the three bands are optimally chosen for the cover type. Analysis of the Santa Cruz scene emphasizes the importance of TM bands 1 and 5 in particular. The three bands of the SPOT scanner are shown to provide sufficient separability for cover types within the study area. The higher spatial resolution data (20 meters) provided by SPOT contain more distinct distributions than data from the other sources studied. Techniques should be developed to exploit this additional information. Author

A86-22842

STATISTICAL ANALYSIS OF SPOT SIMULATION DATA AND COMPARISON WITH LANDSAT 4 THEMATIC MAPPER DATA

J. C. PRICE (USDA, Hydrology Laboratory, Beltsville, MD) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 157-164. refs

Information content and other statistical quantities were obtained for SPOT simulation data from a site in Prince Georges County, Maryland. The results were compared with those from Landsat Thematic Mapper (TM) data. Correlations are very high (greater than 0.97) between bands 1 and 2 for the SPOT simulation data implying significant redundancy between these channels. These values will decrease as the area considered increases from order 10 sq km to the satellite scene size of 60 (sq km). The efficiency of information collection by simulated SPOT is higher than for the TM scene for the same area. This is due to the higher sun angle corresponding to time of year and to the contrast enchancement of the SPOT simulation data. The ability to discriminate subtle load cover differences is poor for single band 10 m data. It is suggested that 6 or 7 bits will be adequate to represent land use/land cover. For large scale agricultural assessment the value of higher spatial resolution from the SPOT sensor as compared to the TM is offset by the longer revisit time. A swath sampling strategy is suggested which would utilize the pointing ability of the SPOT sensors to acquire frequent data for some ground tracks. Author

A86-23221

THE METEOROLOGICAL SATELLITE - OVERVIEW OF 25 YEARS OF OPERATION

W. L. SMITH (Wisconsin, University, Madison), W. P. BISHOP, V. F. DVORAK, C. M. HAYDEN, J. H. MCELROY (NOAA, Washington, DC) et al. Science (ISSN 0036-8075), vol. 231, Jan. 31, 1986, p. 455-462. refs

The origin of the meteorological satellite program is traced to a paper published by Goddard (1919) and a payload launched by him in 1929. Advances in rocket technology made during World War II could be utilized to obtain the first pictures of clouds from high altitude in the late 1940's. The first weather satellite, TIROS-I, was launched on April 1, 1960. A description of further developments regarding meteorological satellites, their operation, and accomplishment is presented. Attention is given to cloud imagery, atmospheric motion estimation, severe storm forecasting, tropical storm surveillance, input to numerical forecast models, quantitative measurements of temperature and moisture, forecast applications, and future expectations. G.R.

A86-23222

TERRESTRIAL OBSERVATIONS FROM NOAA OPERATIONAL SATELLITES

H. YATES, A. STRONG, D. MCGINNIS, JR., and D. TARPLEY (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) Science (ISSN 0036-8075), vol. 231, Jan. 31, 1986, p. 463-470. refs

The original justification for the operational satellites of the National Oceanic and Atmospheric Administration (NOAA) was related to the objective to satisfy the demands of weather forecasting. Although the meteorological functions remain predominant today, there are now, in addition, also important applications in oceanography, hydrology, and agriculture. In the observation of surface features from satellites, the intervening atmosphere represents a source of disturbances. It has been possible to make the correction needed to achieve the requisite accuracy only in the past two years by using multiple infrared channels on the NOAA advanced very high resolution radiometer (AVHRR). G.R.

A86-23283* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

AN EVALUATION AND COMPARISON OF VERTICAL PROFILE DATA FROM THE VISSR ATMOSPHERIC SOUNDER (VAS)

G. J. JEDLOVEC (NASA, Marshall Space Flight Center; Universities Space Research Association, Huntsville, AL) Journal of Atmospheric and Oceanic Technology (ISSN 0739-0572), vol. 2, Dec. 1985, p. 559-581. Research supported by the Universities Space Research Association. Previously announced in STAR as N85-16351. refs
(Contract NAS8-34767)

A statistical evaluation is used to compared vertical profiles of temperature and moisture derived from VISSR Atmospheric Sounder (VAS) with three different algorithms to that of corresponding rawinsonde measurements for a clear cold environment. To account for time and space discrepancies between the data sets, rawinsonde data were adjusted to be representative of the satellite sounding times. Both rawinsonde and satellite sounding data were objectively analyzed onto a mesoscale grid. These grid point values were compared at 50 mb pressure increments from the surface up to 100 mb. The data were analyzed for horizontal and vertical structure, representatives of derived parameters, and significant departure (improvement) from the apriori (first guess) information. Results indicate some rather strong temperature and moisture biases exist in the satellite soundings. Temperature biases of 1 to 4 C and dewpoint biases of 2 to 6 C generally occur in layers where strong inversions are present and vary with time as these atmospheric features evolve. The biases also changes as a function retrieval scheme suggesting limitations and restrictions on the applications of the various techniques. Standard temperature deviations range from 1 to 2 C for each retrieval scheme with maximum values around 800 and 400 mb. Derived parameters (precipitable water and thickness) suffer from similar biases, though to a somewhat lesser extent. Gradients of basic and derived parameters are generally weaker but have good horizontal structure where magnitudes of the parameters are relatively strong. Integrated thermal (temperature) and moisture (precipitable water) parameters show mixed results. B.W.

A86-24103

FRANCE'S SPOT IMAGE TESTS VIABILITY OF REMOTE SENSING IN A COMMERCIAL MARKET

J. M. LENOROVITZ Commercial Space (ISSN 8756-4831), vol. 1, Summer 1985, p. 26, 27, 29 (3 ff.).

The potential market demand for remote sensing imagery from the SPOT satellite is assessed. A brief description of the SPOT spacecraft and imaging equipment is presented, with emphasis given to the Haute Resolution Visible (HRV) cameras. The wholesale and retail segments of a typical SPOT image transaction are described in detail. The copyright laws pertaining to the sale of duplicated SPOT imagery are considered. I.H.

A86-26350

RETRIEVAL OF WORLDWIDE PRECIPITATION AND ALLIED PARAMETERS FROM SATELLITE MICROWAVE OBSERVATIONS

M. S. V. RAO IN: Advances in geophysics. Volume 26 . Orlando, FL, Academic Press, Inc., 1984, p. 237-336. refs

The use of satellite-borne microwave radiometer systems to derive geophysical parameters on a global scale is discussed. The capabilities and limitations of the electrically scanning microwave radiometer (ESMR), Nimbus-5 ESMR, and Nimbus-6 ESMR in calculating rainfall and sea ice parameters are examined. The development of calibration curves to interpret ESMR rainfall data and the verification of the curves are investigated. A comparison of ESMR rainfall maps, generated from calibration curves, with large-scale precipitation maps and localized radar data is presented. The information obtained from the analyses of ESMR rainfall maps concerning new features of global climatology such as a rain area in the South Atlantic, the bimodal behavior of rainbelts in the Indian Ocean, and precipitation in the tropical Atlantic Ocean are described. Storm structure studies and rainfall estimations over land areas conducted with ESMR are analyzed. The application of microwave radiometer systems to the study of atmospheric water content, liquid water content, sea surface temperature, and surface wind is proposed. I.F.

A86-26446* Michigan Univ., Ann Arbor.

MICROWAVE REMOTE SENSING: ACTIVE AND PASSIVE. VOLUME 3 - FROM THEORY TO APPLICATIONS

F. T. ULABY (Michigan, University, Ann Arbor), R. K. MOORE (Kansas, University, Lawrence), and A. K. FUNG (Texas, University, Arlington) Research supported by NASA, NSF, and DOD. Dedham, MA, Artech House, Inc. (Remote Sensing. No. 4), 1986, 1116 p. refs

Aspects of volume scattering and emission theory are discussed, taking into account a weakly scattering medium, the Born approximation, first-order renormalization, the radiative transfer method, and the matrix-doubling method. Other topics explored are related to scatterometers and probing systems, the passive microwave sensing of the atmosphere, the passive microwave sensing of the ocean, the passive microwave sensing of land, the active microwave sensing of land, and radar remote sensing applications. Attention is given to inversion techniques, atmospheric attenuation and emission, a temperature profile retrieval from ground-based observations, mapping rainfall rates, the apparent temperature of the sea, the emission behavior of bare soil surfaces, the emission behavior of vegetation canopies, the emission behavior of snow, wind-vector radar scatterometry, radar measurements of sea ice, and the back-scattering behavior of cultural vegetation canopies. G.R.

A86-29504#
AVNER ELECTRONIC MAGNETIC COMPASS AND LOW COST NAVIGATION SYSTEM
A. SOBEL (Elbit Computers, Ltd., Ground Systems Div., Haifa, Israel) IN: Institute of Navigation, Annual Meeting, 41st, Annapolis, MD, June 25-27, 1985, Proceedings . Washington, DC, Institute of Navigation, 1985, p. 22-28.

A new type of Electronic Magnetic Compass has been developed by Elbit Computers Ltd. This compass corrects the deviations in the Magnetic Compass reading, when mounted on iron body vehicles, by using a classic formula implemented by a microprocessor. This compass is so flexible that it can even correct the deviations caused by the iron body of tanks with rotatable turret. The compass is self calibrated by a computer program which relieves the crew from the complexity of the process. It is argued that this compass has the potential of becoming a low-cost solution to the navigational problems of the large mass of military and commercial land vehicles, aircraft, and ships operating on its own and in conjunction with GPS. The concept and the construction of the compass is explained, some experimental results, and the project status are given. Author

A86-26694
THE IMPORTANCE OF MEASUREMENT ERROR FOR CERTAIN PROCEDURES IN REMOTE SENSING AT OPTICAL WAVELENGTHS
P. J. CURRAN and A. M. HAY (Sheffield, University, England) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, Feb. 1986, p. 229-241. refs

Two problems are identified in the use of linear regression to relate remotely sensed data to ground variables: a specification problem and an errors problem. The extent of the errors is examined for commonly measured remotely sensed variables and ground variables. Three alternative methods of line fitting are examined: Wald's grouping methods, the reduced major axis, and a least-squares procedure. The least-squares method is recommended if the data are available. Author

A86-28273
AMERICAN CONGRESS ON SURVEYING AND MAPPING AND AMERICAN SOCIETY OF PHOTOGRAMMETRY, FALL CONVENTION, SAN ANTONIO, TX, SEPTEMBER 9-14, 1984, TECHNICAL PAPERS
Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1984, 847 p. No individual items are abstracted in this volume.

The use of Landsat data to update the Texas Dam Inventory is considered along with digital image processing using a personal computer, the use of close-range photography in metric recording of archaeological objects, the processes involved in bringing new analytical stereo compilation equipment into production, an innovative approach for developing and using land information, and a tool for mapping electric utilities. Attention is given to applications of parallel processing techniques to geological data processing, age discrimination among basalt flows using digitally enhanced Landsat imagery, the City of Austin computer graphics mapping system, electrical profiling, and exploration remote sensing. Other subjects explored are related to the multilevel exploration of oil and gas with Landsat imagery, a stereoimaging technique for use in the study of the deformation of materials, modern procedures for route surveys, horizontal and vertical positioning by photogrammetric methods, and a satellite Doppler survey within a geodetic reference system. G.R.

A86-29294
METHODS OF SPECTROMETRIC INFORMATION REPRESENTATION AND PROCESSING IN NATURAL SURFACE CLASSIFICATION PROBLEMS [METODY PREDSTAVLENIIA I OBRABOTKI SPEKTROMETRICHESKOI INFORMATSII V ZADACHAKH KLASSIFIKATSII PRIRODNYKH POVERKHNOSTEI]
L. I. KISELEVSKI, A. M. VESHTORT, S. I. KONONOVICH, S. S. KOSTIUKEVICH, and V. V. KRASNOPROSHIN (Belorusskii Gosudarstvennyi Universitet; AN BSSR, Institut Fiziki, Minsk, Belorussian SSR) Akademiia Nauk BSSR, Doklady (ISSN 0002-354X), vol. 30, no. 2, 1986, p. 128-131. In Russian. refs

A86-29403
GENERATING FALSE-COLOR COMPOSITES WITH A WHITE-LIGHT OPTICAL PROCESSOR
F. T. S. YU and G. W. PETERSEN (Pennsylvania State University, University Park) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, March 1986, p. 367-371. USAF-DOE-supported research. refs

A technique of false-color compositing by encoding multispectral remote sensing data with a low-cost white-light optical processor is described. Spatial encodings are made with various multispectral band image transparencies, and false-coloring is obtained by color filtering the smeared Fourier spectra. In contrast to the low-resolution digital image, the white-light method generates a high-quality color-coded product. This image is free from coherent artifact noise because coherent light sources are not used. The simple and versatile technique may offer a wide range of applications. Three bands of multispectral Landsat data were processed using 70-mm black-and-white film negatives. These false-color encoded images allowed for discrimination of various earth surface features. Forests, agricultural lands, water, urban areas, and strip mines could be shown on the images as each of these thematic classes were displayed as a different color. Author

N86-16690*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
STUDY OF SPECTRAL/RADIOMETRIC CHARACTERISTICS OF THE THEMATIC MAPPER FOR LAND USE APPLICATIONS Final Report, 21 Sep. 1982 - 30 Jun. 1985
W. A. MALILA, Principal Investigator and M. D. METZLER, Principal Investigator Sep. 1985 54 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS5-27346)
(E86-10025; NASA-CR-176269; NAS 1.26:176269;
ERIM-164000-19-F) Avail: NTIS HC A04/MF A01 CSCL 08B

An investigation conducted in support of the LANDSAT 4/5 Image Data Quality Analysis (LIDQA) Program is discussed. Results of engineering analyses of radiometric, spatial, spectral, and geometric properties of the Thematic Mapper systems are summarized; major emphasis is placed on the radiometric analysis. Details of the analyses are presented in appendices, which contain three of the eight technical papers produced during the investigation; these three, together, describe the major activities and results of the investigation.

N86-16691*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
STUDY OF SPECTRAL/RADIOMETRIC CHARACTERISTICS OF THE THEMATIC MAPPER FOR LAND USE APPLICATIONS: OBJECTIVES, ACCOMPLISHMENTS, CONCLUSIONS, AND RECOMMENDATIONS Final Report
W. A. MALILA and M. D. METZLER *In its* Study on Spectral/Radiometric Characteristics of the Thematic Mapper for Land Use Applications p 1-4 Sep. 1985 refs ERTS
Avail: NTIS HC A04/MF A01 CSCL 05B

The objectives of this investigation are to quantify the performance of the Thematic Mapper, as manifested by the quality of its image data, in order to suggest improvements in data production and to assess the effects of the data quality on its

utility for land resources applications. Analyses of radiometric, spatial, spectral, and geometric effects, with primary emphasis on radiometric effects are included. This effort is part of the LANDSAT 4/5 Image Data Quality Analysis (LIDQA) program sponsored by the NASA Goddard Space Flight Center. Author

N86-16692*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
CHARACTERIZATION OF LANDSAT-4 MSS AND TM DIGITAL IMAGE DATA
W. A. MALILA, M. D. METZLER, D. P. RICE, and E. P. CRIST *In its* Study on Spectral/Radiometric Characteristics of the Thematic Mapper for Land Use Applications p 5-20 Sep. 1985 refs Repr. from IEEE Transactions on Geoscience and Remote Sensing, v. GE-22, no. 3, May 1984 p 177-191 Previously announced in IAA as A84-33526 Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS5-27254)
Avail: NTIS HC A04/MF A01 CSCL 05B

The launch of LANDSAT-4 in July 1982 represents a continuation in the remote sensing of earth resources. The 80-m spatial resolution provided by the Multispectral Scanner (MSS) on board the satellite is fine enough to resolve many natural features and land-use details in both rural and urban settings. The second sensor of the spacecraft, the Thematic Mapper (TM), introduce a new era of sensing with refined spatial resolution (30 m) and expanded spectral coverage (7 bands). This paper describes results from engineering studies of the characteristics of digital image data from the two LANDSAT-4 sensors are described. These studies form a part of the LANDSAT-4 Image Data Quality Analysis program (LIDQA). The image data were generally found to be of high quality and the TM provided several improvements over the MSS, in its spatial and spectral characteristics. Author

N86-16693*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
CHARACTERIZATION AND COMPARISON OF LANDSAT-4 AND LANDSAT-5 THEMATIC MAPPER DATA
W. A. MALILA and M. D. METZLER *In its* Study on Spectral/Radiometric Characteristics of the Thematic Mapper for Land Use Applications p 21-37 Sep. 1985 refs Repr. from Photogrammetric Engineering and Remote Sensing, v. 51, no. 9, Sep. 1985 p 1315-1330 Previously announced in IAA as A85-47809 ERTS
Avail: NTIS HC A04/MF A01 CSCL 08B

Engineering analyses of Thematic Mapper (TM) image data have been conducted, giving particular attention to the radiometric characterization of the sensor. While the data in general were found to be excellent, anomalies do exist in the data from both LANDSAT-4 and LANDSAT-5 TM. A summary is provided of the LANDSAT-5 TM image data. Recent analyses of LANDSAT-5 TM data and comparisons of the radiometry of the two sensors are emphasized. One of the specific topics covered is within-line droop, a phenomenon whereby the signal levels of the sensor change systematically during the active scan. Attention is also given to scan-correlated level shifts, an effect which raises or lowers the signal level of all pixels in a scan line or set of scan lines. A comparison of LANDSAT-4 and LANDSAT-5 radiometric corrections is also discussed. Author

N86-17814*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CNPQ/INPE-LANDSAT SYSTEM Report of Activities, 1 Oct. 1984 - 31 Aug. 1985
J. L. DEBARROSAGUIRRE Sep. 1985 28 p Presented at the LANDSAT Ground Station Operators Working Group and LGSOWG Data Distribution and Marketing Working Group meetings, Washington, D.C., Sep. 1985 Sponsored by NASA ERTS
(E86-10019; NASA-CR-175884; NAS 1.26:175884; INPE-3635-PRE/812) Avail: NTIS HC A03/MF A01 CSCL 05B

The current status of the Brazilian LANDSAT facilities operated by Instituto de Pesquisas Espaciais (INPE) and the results achieved during the period from October 1, 1984 to August 31, 1985 are presented. INPE's Receiving Station at Cuiaba, MT, operates normally the two tracking and receiving systems it has installed, the old one (1973) for Band S and the new one (February 1983) for dual S- and X-band. Both MSS and TM recording capabilities are functional. Support to the NASA Backup Plan for MSS data also remains active. Routine recordings are being made for LANDSAT-5 only, for both MSS and TM. Originally, MSS was recorded over the full acquisition range. However, since December, 1984, due to further reduction of operational expenses, both instruments are being recorded over Brazilian territory only. Author

N86-17816*# Arizona Univ., Tucson. Optical Sciences Center.
SPECTRORADIOMETRIC CALIBRATION OF THE THEMATIC MAPPER AND MULTISPECTRAL SCANNER SYSTEM Quarterly Report, 1 Jun. - 31 Aug. 1985
P. N. SLATER and J. M. PALMER, Principal Investigators 30 Sep. 1985 18 p ERTS
(Contract NAS5-27832)
(E86-10022; NASA-CR-175861; NAS 1.26:175861; QR-11) Avail: NTIS HC A02/MF A01 CSCL 08B

The eleventh quarterly report on Spectroradiometric Calibration of the Thematic Mapper (Contract NAS5-27832) discusses calibrations made at White Sands on 24 May 1985. An attempt is made to standardize test results. Critical values used in the final steps of the data reduction and the comparison of the results of the pre-flight and internal calibration (IC) data are summarized. F.M.R.

N86-18351# European Space Agency, Paris (France).
PROCEEDINGS OF THE EARSEL/ESA SYMPOSIUM ON EUROPEAN REMOTE SENSING OPPORTUNITIES: SYSTEMS, SENSORS, AND APPLICATIONS
N. LONGDON, comp. and O. MELITA, comp. Jun. 1985 267 p refs Partly in ENGLISH and FRENCH Proc. held in Strasbourg, 31 Mar. - 3 Apr. 1985; sponsored by Council of Europe, Commission of the European Communities, CNES and Strasbourg University
(ESA-SP-233; ISSN-0379-6566) Avail: NTIS HC A12/MF A01

Remote sensing platforms and sensors; collection, processing, and dissemination of remotely sensed data in Europe; Spacelab Metric Camera experiments; the Modular Opto-electronic Multispectral Scanner; and remote sensing applications to thematic mapping, pollution monitoring, archaeology, and geology were discussed.

N86-18353# Marconi Space Systems Ltd., Portsmouth (England).
THE ERS-1 ACTIVE MICROWAVE INSTRUMENTATION (AMI) DESIGN CONSTRAINTS
F. G. SAWYER and D. J. Q. CARTER *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 13-19 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

The requirements for the ERS-1 Active Microwave Instrument (AMI) to act as a wind scatterometer, a wave scatterometer and an imaging radar are considered. For the second two instruments the AMI is configured to operate as a synthetic aperture radar and performance requirements in these two modes are very similar;

for the first instrument it is configured to operate as a noncoherent pulsed radar. Design constraints resulting from function requirements, on-board radar components, the ERS-1 platform and interfaces, and ground processing equipment are considered.
Author (ESA)

N86-18359# Politecnico di Milano (Italy). Ist. di Topografia, Fotogrammetria e Geofisica.
OUTSTANDING RESULTS FROM ONE YEAR'S ACTIVITIES OF THE ESA METRIC CAMERA WORKING GROUP
G. TOGLIATTI *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 57-61 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

Results of the Spacelab Metric Camera experiment on STS-9 in photogrammetry: (precision, triangulations, point identification and mapping, orthophotos); thematic interpretations; and geological interpretation are summarized. Performance is fairly satisfactory in topographic mapping and in geological and thematic applications, with shortcomings in features identification, mainly due to poor lighting conditions and absence of image motion compensation. The metric accuracy of the images is very good, and in several cases better than expected. Author (ESA)

N86-18361# Technische Univ., Hanover (West Germany). Inst. for Photogrammetry and Engineering Surveys.
LINE MAP PRODUCTION WITH METRIC CAMERA DATA
G. KONECNY and W. SCHUHR *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 69-73 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

The way to derive empiric exposure functions for optimal picture quality and to get the Modulation Transfer Function (MTF) from edge analysis; and photogrammetric evaluations of Spacelab Metric Camera imagery to derive line maps and quasi line maps are dealt with. It is possible to derive sufficient information from high altitude photography to estimate an empiric solar angle and diaphragm depending empiric exposure function for space photography. From edge analyses the MTF shows 40 line pairs per mm for extremely high contrast, which is equivalent to 10 m pixel size on the ground. The imagery is sufficient for topographic mapping on scales of 1:100 000, and meets all requirements of a reference data base for medium scale mapping purposes. Conventional line maps derived from photogrammetric evaluation with analytical plotters and quasi line maps from digital edge-enhanced Metric Camera imagery are promising for map production in developing countries. Author (ESA)

N86-18362# Institut National de la Recherche Agronomique, Paris (France).
USE OF METRIC CAMERA FOR LANDSCAPE UNITS: DESCRIPTION AND MAPPING
C. M. GIRARD *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 75-78 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

Data from a Spacelab Metric Camera flight in winter over France were used to describe landscape units. The use of stereoscopy enabled the description of data concerning geomorphology, which was not possible when using LANDSAT images. The color infrared film enabled to distinguish and evaluate vegetation. The high resolution permitted to evaluate the field size and the presence of hedges. The main types of land use were recognized and the comparison of landscape units with government publications is encouraging. Author (ESA)

N86-18363# Technische Univ., Munich (West Germany). Lehrstuhl fuer Geographie und Geographische Fernerkundung.
ANALYSIS OF THE METRIC CAMERA MC-BW FOR LAND USE CLASSIFICATION AND LAND USE HAZARD MANAGEMENT (THEMATIC MAPPING OF METRIC CAMERA SPACELAB BLACK AND WHITE PHOTOGRAPHS)
H. G. GIERLOFF-EMDEN *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 79-84 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

Metric Camera (MC) photographs were analyzed concerning land use and classification, and thematic mapping in test areas in Chihahua, Mexico. Ground check was carried out in the test areas (not at the same time as the flight). Results show that an MC-image could serve as auxiliary means for thematic mapping in scales around 1:100,000 and smaller scales of larger areas.
Author (ESA)

N86-18366# Karlsruhe Univ. (West Germany). Inst. fuer Photogrammetry and Topography.
FUTURE MODULAR OPTOELECTRONIC MULTISPECTRAL SCANNER (MOMS) DEVELOPMENTS: DISCUSSION OF IMPROVEMENTS AND POSSIBILITIES TO BE EXPECTED FOR GEOLOGICAL APPLICATIONS
J. BODECHTEL (Technische Univ., Munich, West Germany) and H. KAUFMANN *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 93-96 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

On the basis of digital terrain models and corresponding thematic mapper data, the impact of MOMS instrument developments like Stereo-MOMS and SWIR-MOMS are discussed to optimize parameters especially for geology applications. Choice and width of bands, and application oriented processing concepts are considered. Author (ESA)

N86-18369# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Wesseling (West Germany).
AN OPTICAL MULTISENSOR COMBINING MID IR LASER SCANNER, AND NEAR IR MULTISPECTRAL SCANNER (LIMES)
F. LEHMANN, C. WERNER, and W. WIESEMANN (Battelle Inst.) *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 115-119 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

The application possibilities of thermal infrared laser spectroscopy for remote sensing were investigated in laboratory and flight campaigns. For the flight measurements, a profiling laser spectrometer with 2 tunable CO_2 lasers was used. In the laboratory, the reflection spectra of minerals, soils, rocks, vegetation, water, moistened surfaces and oil spills on water were taken. Flight measurements (soil, rock surfaces, water, irrigated field, vegetation, asphalt) agree with the laboratory results (in-situ measurements). Based on these results, a program for the development of an optical multisensor, combining mid IR laser scanner and near IR-multispectral scanner was started. Author (ESA)

N86-18375# University Coll., London (England). Dept. of Electrical Engineering.
GEOPHYSICAL RADAR ALTIMETERS FOR THE 1990'S
H. D. GRIFFITHS and C. G. RAPLEY *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 157-165 Jun. 1985 refs Sponsored by ESA
Avail: NTIS HC A12/MF A01

Satellite-borne altimeter concepts for altimetric mission are described. These include developments in on-board adaptive processing algorithms and advances in radar hardware technology, which allow significantly-increased coverage of land and land ice surfaces. Beam-limited altimeters overcome the fundamental disadvantages of pulse-limited instruments over these surfaces, and allow considerably lower transmitter powers, though at the expense of large antenna structures and severe spacecraft pointing constraints. Concepts for antenna signal processing utilizing multiple antenna beams to give increased spatial coverage as well as improved performance over nonocean surfaces are presented. Author (ESA)

N86-19376# Centre National d'Etudes Spatiales, Toulouse (France).
THE VARAN-S: AN AIRBORNE SYNTHETIC APERTURE RADAR FOR RESEARCH IN MICROWAVE REMOTE SENSING
D. VAILLANT *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 167-174 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

The VARAN-S X-Band side-looking airborne radar was designed to simulate satellite-borne radar images to prepare microwave remote sensing users for future satellite data analyses, and to help in the development of satellite-borne SAR. It was experimented in real aperture mode during the Marginal Ice Zone experiment. The VARAN-S is planned to work in SAR mode. The digital raw data, recorded on-board over a swath width 10 km, gives 3 m resolution without multilook, or 9 m using 9 looks. Two polarizations (H and V) are available. Author (ESA)

N86-19705# Meteorological Office, Bracknell (England).
WIND DIRECTION AMBIGUITY SUPPRESSION ALGORITHMS
D. OFFILER *In* ESA The Use of Satellite Data in Climate Models p 175-176 Sep. 1985 refs
(Contract ESA-6154/85/NL-BI)
Avail: NTIS HC A10/MF A01

The problem of removing the ambiguity in the ERS-1 Active Microwave Instrument scatterometer wind directions is discussed. The scatterometer product was simulated using the C-band model with winds from the UK Meteorological Office forecast model. Objective and subjective means were used to suppress the ambiguity. The objective method was divided into two separate algorithms: one using no external data, the other using an independent wind field. The algorithms are described and results presented. Author (ESA)

N86-19709 New South Wales Univ., Kensington (Australia).
A COMPARISON OF SPACE VECTORS DERIVED FROM SATELLITE DOPPLER OBSERVATIONS Abstract Only
D. F. WOOD 1984 2 p
Avail: Issuing Activity

A multi-station Doppler observation program was conducted across the Australian continent between February and June of 1982. Each phase of the program included up to thirteen Doppler Satellite receivers which had been manufactured by the Magnavox Company in U.S.A. The object of this project was to ascertain the accuracy of the Magnavox receivers in determining a position by the technique of semi-short arc translocation when compared to known terrestrial data. The Magnavox results have also been compared to the same satellite data which was processed in the computer programs PREDOP-GEODOP. Author

N86-20260# Joint Publications Research Service, Arlington, Va.
USE OF A PRIORI EVALUATION OF CONDITIONS FOR OBSERVING EARTH'S SURFACE FROM SPACE FOR EFFECTIVE CHOICE OF TIME FOR EXECUTING SURVEY Abstract Only
N. V. KAPITONOVA and Y. L. LUKASHEVICH *In its* USSR Report: Space (JPRS-USP-86-001) p 155 13 Jan. 1986 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 1, Jan. - Feb. 1985 p 113-117 Original language document was announced in IAA as A85-29914
Avail: NTIS HC A03

Adequate study has been made of the motion of space vehicles for studying the Earth's natural resources, such as the nominal parameters of their working orbits, but a weak link which remains is the uncertainty in choice of the initial orientation of the orbital plane relative to the direction to the Sun. This orientation is determined by the angle tau = alpha-omega, where alpha is the right ascension of the Sun on the initial date of the survey, omega is the longitude of the ascending node of the space vehicle orbit, unambiguously related to the illumination conditions for the Earth's surface along the flight trajectory. A method has been developed for determining a rational omega value which would make possible the most complete satisfaction of requirements on solar altitude in surveys of different regions, taking their meteorological and climatic characteristics into account. For this purpose the Earth's surface, which is to be photographed from a circular orbit from a satellite with a specific inclination, is broken down into regions with characteristic climatic conditions. R.J.F.

N86-20436# Joint Publications Research Service, Arlington, Va.
WORLD'S LARGEST CAMERA FOR SATELLITE OBSERVATION INSTALLED AT ZVENIGOROD
M. ROGOZHNIKOV *In its* USSR Report: Space (JPRS-USP-86-002) p 18-19 10 Feb. 1986 Transl. into ENGLISH from Leninskoye Znamya (Moscow, USSR), 17 Oct. 1985 p 4
Avail: NTIS HC A05

The world's largest camera for observing artificial Earth satellites was installed at the Zvenigorod station of the USSR Academy of Sciences' Astronomical Council. Small deviations of geostationary satellites from their prescribed orbits sometimes occur. At regular intervals, it is necessary to give them a push -- to correct their orbits. The photographing of satellites from Earth is still the most precise and accurate method for determining their coordinates. The camera was installed near Zvenigorod for this purpose. Author

N86-20912# Joint Publications Research Service, Arlington, Va.
RADIOMETRIC AIRBORNE MOISTURE METER
M. GUSEV *In its* USSR Report: Earth Sciences (JPRS-UES-86-001) p 34 10 Jan. 1986 Transl. into ENGLISH from Trud (Moscow, USSR), 19 Jul. 1985 p 4
Avail: NTIS HC A04

The moisture meter is an instrument which gives accurate recording of the presence of moisture in the ground from an airplane. With the aid of the meter, the reasons for the flooding of three settlements with ground water were established and the place where the ground water was accumulating was discovered. As the temperature of the ground changes, changes also occur in the boundaries of this spectrum and the ground's radiation-brightness temperature which very according to the amount of moisture. The instrument measures the ground's radiation brightness temperature. E.A.K.

N86-20636# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE BRAZILIAN REPORT TO THE 7TH LANDSAT TECHNICAL WORKING GROUP (LTWG) MEETING
J. L. D. AQUIRRE, L. E. M. PARADA, and S. D. PEREIRA Oct. 1985 10 p Presented at the 7th LTWG Meeting, Williamsburg, Va., 26 Feb. - 1 Mar. 1985 Sponsored by NASA
(NASA-CR-176592; NAS 1.26:176592; INPE-3672-PRE/826)
Avail: NTIS HC A02/MF A01 CSCL 05B

Described is the current status of the INPE LANDSAT receiving and processing facilities, as well as the experience in the related activities during the period from June 1984 to February 1985. Author

N86-20637*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
BRAZIL'S REMOTE SENSING ACTIVITIES IN THE EIGHTIES
M. A. RAUPP, R. PEREIRADACUNHA, and R. A. NOVAES Oct. 1985 7 p Presented at the 5th Selper Meeting, Ottawa, Ontario, 15-19 Jul. 1985
(NASA-CR-176591; NAS 1.26:176591; INPE-3671-PRE/825)
Avail: NTIS HC A02/MF A01 CSCL 05B

Most of the remote sensing activities in Brazil have been conducted by the Institute for Space Research (INPE). This report describes briefly INPE's activities in remote sensing in the last years. INPE has been engaged in research (e.g., radiance studies), development (e.g., CCD-scanners, image processing devices) and applications (e.g., crop survey, land use, mineral resources, etc.) of remote sensing. INPE is also responsible for the operation (data reception and processing) of the LANDSATs and meteorological satellites. Data acquisition activities include the development of CCD-Camera to be deployed on board the space shuttle and the construction of a remote sensing satellite.

Author

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GENERAL

Includes economic analysis.

A86-19487

REMOTE SENSING RESEARCH - THE PAST AS PROLOG

D. A. LANDGREBE (Purdue University, West Lafayette, IN) IN: Remote sensing; Proceedings of the Meeting, Arlington, VA, May 1, 2, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 130-135.

It is pointed out that the remote sensing community has a major opportunity at the present time which it must seize and use effectively. This opportunity is related to the undeveloped potential of the technology, the base of new fundamental knowledge now available, and the recognition that some good planning must now be done. The basic elements of a remote sensing research program are introduced, and the assembly of these elements into a unified program is considered. The elements of the development dimension include basic research, technology research, earth surface research, application research, projects, and operations. Elements of the system dimension include sensor, preprocessing, data analysis, and user application. G.R.

A86-19488

MAPPING THE EARTH FROM SPACE IN THE 1980'S

R. WELCH (Georgia, University, Athens) IN: Remote sensing; Proceedings of the Meeting, Arlington, VA, May 1, 2, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 136-146. refs

The present paper has the objective to review the status of mapping the earth from satellite image data. Since the launch of Landsat-1 by NASA in 1972, satellite remote sensing has expanded rapidly. Major programs concerned with the provision of image data on a global basis are currently being developed by the governments of Canada, France, Germany, India, and Japan, as well as by the U.S. Satellite data which are suited for mapping applications must have adequate spatial and spectral resolution to permit the compilation of cartographic products at scales of 1:25,000 to 1:100,000. Attention is given to aspects of resolution, geometry, planimetry, elevations, and the merging of data sets.

G.R.

A86-19489

FUTURE OF REMOTE SENSING - A VIEWPOINT FROM INDUSTRY

A. B. PARK (Natural Resources Consulting Services, Arnold, MD) IN: Remote sensing; Proceedings of the Meeting, Arlington, VA, May 1, 2, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 148-151.

It appears that the present paper is presented at a critical time in the life of land remote sensing. The technology involved is just over 20 years old, and remote sensing has undergone a remarkable growth during this time. An intensive effort is currently being made to create a Commercial Land Remote Sensing (CRLS) system including both space and ground segments. The present time represents a major milestone in remote sensing. This milestone serves to divide the program into two segments, including a research program largely but not completely sponsored by the Federal Government, and commercial program driven almost entirely by the profit motive. Over the past five years, industry has intensely studied the viability of a commercial program. It was concluded that money could be made by industry in operating the ground segment. Such a result leaves in the hands of the government the space segment and the space/ground communications responsibility. G.R.

A86-19490

RECENT ADVANCES IN CIVIL SPACE REMOTE SENSING; PROCEEDINGS OF THE MEETING, ARLINGTON, VA, MAY 3, 4, 1984

H. W. YATES, ED. (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) Meeting sponsored by SPIE - The International Society for Optical Engineering. Bellingham, WA, SPIE - The International Society for Optical Engineering (SPIE Proceedings. Volume 481), 1984, 1273 p. For individual items see A86-19491 to A86-19522.

(SPIE-481)

Attention is given to sensing in the areas of land observation, meteorology, oceanography, and agriculture and hydrology. Among the specific topics addressed are: the multispectral linear array; optical-system design for next-generation pushbroom sensors; satellite remote sensing for aluminum and nickel laterites; the use of CSIS in severe weather prediction; review of experiments on the impact of satellite data on numerical weather prediction; and WINDSAT, a concept of global wind measurement by IF Doppler lidar. Also considered are: a GPS-based tracking system for TOPEX orbit determination; the low-frequency microwave radiometer for N-ROSS; an integrated approach to global crop monitoring, the microwave remote sensing of soil moisture; and the estimation of moisture conditions from AVHRR data. B.J.

A86-19861#

NATIONAL AND INTERNATIONAL COOPERATION IN REMOTE SENSING AND APPLICATIONS

R. J. KEATING (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) AIAA, Aerospace Sciences Meeting, 24th, Reno, NV, Jan. 6-9, 1986. 8 p.

(AIAA PAPER 86-0412)

This paper provides an overview of the United States remote sensing satellite systems and how they complement those of our foreign partners. In addition, the paper describes the international cooperative efforts to achieve complementarity and compatibility of these satellite systems. Specific uses of the data and their applications are described. Author

A86-21118#

REMOTE SENSING AND THE DEVELOPMENT PROCESS

C. K. PAUL (Agency for International Development, Washington, DC) and W. H. WIGTON (Agricultural Assessments International, Upper Marlboro, MD) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 201-205.

Science applied to the development process by private industry can increase productivity, capital, and employment. Local remote sensing institutions provide the baseline data for infrastructure planning. The technology of remote sensing is used in many developing countries for environmental assessment and management of natural resources. Remote sensing has proved its use in addressing the development sectors of agriculture, health, population, nutrition, education, water, housing, and energy. The technology becomes more effective when used with geographic information systems and models. Remote sensing carries social and economic considerations along with its known benefits. There are sensitivities to data collection in developing countries very different than those in the north. Costs of equipment and training are not only high and direct, but they are manifested in loss of opportunities to pursue other technologies which may or may not be more relevant to development problems in certain countries. Labor displacement by automated analysis equipment is a genuine concern. The need to learn how to manage projects and to conduct good business policy is acute. The reliance on machine complexity is risky. All of these factors must be taken into account; how they are will set the direction of remote sensing policy and applications. Author

A86-21119#

PLANNING FOR THE APPROPRIATE TRANSFER OF REMOTE SENSING TECHNOLOGIES INTO DEVELOPING COUNTRIES - RECOMMENDATIONS FOR AN INSTITUTIONAL IMPACT PROCESS

B. SELLMAN (Michigan, Environmental Research Institute, Ann Arbor) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 207-213. refs

The criteria for the planning and evaluating of remote sensing technology transfer processes are presented. The need for a realistic time frame in which to accomplish the objectives of the transfer, and the preparation of an estimate of the oveall cost of the project are discussed. The training of a staff to operate the project and the establishment of educational programs to sustain it are examined. It is concluded that emphasis needs to be placed on the training of personnel and not on the purchasing of hardware. I.F.

A86-21120#

THE REGIONAL REMOTE SENSING FACILITY FOR EASTERN AND SOUTHERN AFRICA

V. A. O. ODENYO (Regional Remote Sensing Facility, Nairobi, Kenya) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 215-228. refs

The Regional Remote Sensing Facility in Nairobi, Kenya, was the first regional technology transfer program for remote sensing established by the United States Agency for International Development. It was initially funded in 1977, and serves 20 countries in eastern and southern Africa with a professional and support staff of sixteen people. The Facility has provided a technology transfer program of short term (3 weeks) and extended training courses, user assistance services and project support. Emphasis has been on analog techniques on Landsat obtained data. To date, more than 500 participants have benefited from the Facility's discipline-specific training courses. The three program areas are supported by an excellent black-and-white and color photo laboratory complex for processing Landsat images. The Facility has a vast imagery collection providing an extensive range of imagery products. Recent projects include soil and land capability mapping in Zambia, forestry mapping in Tanzania, highway corridor assessment in the Sudan, and experimental cartography products in Kenya, Swaziland and the Sudan. Many annotated images or image mosaics have been produced for distribution to potential users for information and demonstration. Customer-tailored images are often prepared at users' request. Author

A86-21121#

REMOTE SENSING ACTIVITIES IN LATIN AMERICA

N. J. PARADA (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 229-240.

This paper presents the status quo of remote sensing in Latin America. It opens with a brief discussion on the reasons, motivations, and importance of remote sensing activities in the Latin American environment. In the field of data reception, processing, distribution, and utilization, it presents the efforts made to improve those aspects which are vital to the whole process of remote sensing. Here, specific countries with their programs and projects are mentioned, briefly depicting the unique position of remote sensing in Latin America. It also concisely describes the Brazilian Remote Sensing Experiment (BRESEX) and its future utilization on the Brazilian Complete Space Mission to be carried out onboard the Shuttle. Finally, the importance of regional societies, symposia and training programs is described, followed by conclusions and recommendations. Author

A86-21123#

THE NEEDS OF DEVELOPING COUNTRIES IN THE APPLICATION OF SATELLITE TECHNOLOGY FOR DISASTER MANAGEMENT

C. VOUTE (International Institute for Aerospace Survey and Earth Sciences, Enschede, Netherlands) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 247-261. refs

The possible use of space technology for disaster management is discussed in terms of disaster prevention, disaster preparedness and disaster relief operations, with emphasis on remote sensing applications. Specific needs of developing countries are identified. It is suggested that remote sensing imagery should not only be used for disaster prevention measures, disaster preparedness planning and damage assessment in case of emergencies, but also for audio-visual training programs and for on-site information of relief workers. Author

A86-21126#

USE OF SATELLITE DATA IN INTERNATIONAL DISASTER MANAGEMENT THE VIEW FROM THE U.S. DEPARTMENT OF STATE

L. A. ROSE (U.S. Department of State, Bureau of Oceans and International Environmental and Scientific Affairs, Washington, DC) and P. F. KRUMPE (Agency for International Development, Washington, DC) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 301-306.

Requirements are elaborated that must be met in a joint program wherein the U.S. Department of State and the U.S. Agency for International Development are actively exploring ways of using satellite data in emergency preparedness and disaster warning worldwide. Considerations that must be taken into account include: the limits of satellite technology and data in providing effective disaster warning; the fact that cost and competing claims on national resources do not permit research and development specifically targeted at creation of disaster early warning capabilities for satellites; the need of disaster-prone nations to provide substantial resources of their own to ensure that satellite warnings reach the affected areas in time; the continuing impossibility of precise prediction of natural disasters; and the long lead-time to establish a truly global disaster warning system. D.H.

A86-21132#

COMPLEMENTARY ROLE OF INDUSTRY IN UK NATIONAL REMOTE SENSING PROGRAMME

G. K. C. PARDOE (General Technology Systems, Ltd., Brentford, England) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 367-376. Sponsorship: Department of Trade and Industry.
(Contract DTI-83004)

Industry can act as a driver to push forward the use of remote sensing technology in both the public and private sectors with substantial benefits flowing from the integration of new data sources into existing structures. For this enabling technology to be included in operational tasks, mechanisms must be in place to: archive the data, assist users to access the data, disseminate the data promptly to users, and integrate it into user work plans. Industry provides the vital link in ensuring that new technology programs result in commercial benefits. The United Kingdom program recognizes this complementarity between research and development groups and industry, acknowledges the compatible strengths of each, and has integrated both aspects into a national programme. Those aspects where industry can assist are outlined, as is the role of industry in the current UK program. Author

A86-21133#

VALUE ADDED SERVICES - THE INDUSTRY AND THE USER

C. L. WILSON (Michigan, Environmental Research Intitute, Ann Arbor) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 377-380.

'Value added service' is viewed from the perspective of the operations of the Earth Resources Data Center (ERDC) of the Environmental Research Institute of Michigan. 'Value added service' is defined and the market described in terms of size and customer mix. The industry and the user are described as are their attitudes and interests. The issues affecting Value Added Services, as perceived by the author, as they have occurred in the past and extrapolated to the future are presented. Finally, the concerns of the value added industry for the future are discussed. Author

A86-21134#

INDUSTRIAL INVESTMENT IN REMOTE SENSING

G. TORDION (Societe Europeenne de Propulsion, Puteaux, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984. Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 381-385.

Remote sensing, as a new and fast growing field certainly proposes many attractive markets to industrial investors. On the other hand, remote sensing is a rather difficult and risky field for industrial investors, as it requires new technical and new technology for the solution of new problems. This paper discusses some of the issues related to how industrial investment takes place in remote sensing, based on the example and the experience of a French aerospace company which has developed an important activity in the remote sensing ground segment area. Author

A86-21135#

INDUSTRIAL DEVELOPMENT AND INTERNATIONAL COOPERATION [DEVELOPPEMENT INDUSTRIEL ET COOPERATION INTERNATIONALE]

M. BIED-CHARRETON (Ministere des Relations Exterieures, Paris, France) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 389-397. In French.

Various aspects of the use of remote sensing to benefit developing countries are discussed. Particular consideration is given to: (1) the needs of developing countries with respect to remote sensing; (2) constraints on the utilization of remote sensing in an operational mode in developing countries; and (3) missions for industry. B.J.

A86-21137#

TROPICAL EARTH RESOURCES SATELLITE (TERS)

R. VAN KONIJNENBURG (Nederlands Instituut voor Vliegtuiguntwikkeling en Ruimtevaart, Delft, Netherlands) and M. IRSYAM (Indonesian National Institute of Aeronautics and Space, Jakarta, Indonesia) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 409-417.

Studies have been performed on the feasibility of a Tropical Earth Resources Satellite system, including a preliminary design of space and ground segment as well as studies on user aspects and the cloud distribution over Indonesia. The baseline of the Tropical Earth Resources Satellite (TERS) concept is a remote sensing satellite with a pushbroom optical instrument in a true equatorial orbit (1680 km). The TERS, conceived for the equatorial countries and Indonesia in particular, will complement the already existing or planned remote sensing satellites, and will especially improve the temporal resolution of the remote sensing data on these countries. It is anticipated that such a satellite will enable monitoring of critical processes in the field of food production, forestry, conservation of the natural environment and land usage. The swath-width of the high resolution multispectral instrument can be pointed anywhere between latitude 10 deg N and 10 deg S, which will offer the equatorial countries an opportunity to observe any part of their territory four times per day during daylight. A forward looking cloud sensor will give the possibility to detect which areas are free of clouds and to point the observation instrument accordingly. Author

A86-21172#

LEAP - LANDSAT EMERGENCY ACCESS AND PRODUCTS, AN OPERATIONAL USE OF LANDSAT DATA FOR DAMAGE ASSESSMENT

D. E. LICHY (U.S. Army, Corps of Engineering, Fort Belvoir, VA), D. PEPE (NOAA, Washington, DC), and N. D. LEPPERT (USDA, Washington, DC) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 835-844.

Procedures developed for the LEAP (Landsat Emergency Access and Products) program are described. In the fall of 1983, the National Oceanic and Atmospheric Administration (NOAA), which operates the Landsat MSS, in cooperation with the U.S. Army Corps of Engineers, developed, tested, and evaluated procedures for the acquisition of Landsat imagery in response to natural and national disasters. The prime purpose of LEAP is to provide satellite imagery to the requester within 12 to 24 hours after acquisition by the spacecraft. Several case studies of the Corps of Engineers and the U.S. Department of Agriculture have successfully been tested. Procedures to integrate the new products are presented; the user community must develop special methods for handling LEAP data. D.H.

A86-21518

REMOTE SENSING - A FORMIDABLE TOOL FOR MANKIND

G. K. C. PARDOE Space (ISSN 0267-954X), vol. 1, June 1985, p. 12-15, 17.

A state-of-the-art assessment is made of the performance capabilities and applications impact of satellite-borne earth sensing techniques (false color photography, synthetic aperture radar, etc.) as carried out by such spacecraft as Nimbus, Seasat and Landsat. The remote sensing prospects offered by NASA's projected Space Station are discussed, and the development status and performance capabilities of the Tropical Earth Resource Satellite and the SPOT remote sensing satellite of France are noted. Attention is given to the need for intersatellite data links. O.C.

A86-22827

THE SPOT PROGRAM - ORGANIZATION AND DATA DISTRIBUTION POLICY

G. BRACHET (SPOT Image, S.A., Toulouse, France) IN: SPOT simulation applications handbook; Proceedings of the SPOT Symposium, Scottsdale, AZ, May 20-23, 1984 . Falls Church, VA, American Society of Photogrammetry, 1984, p. 3-7.

The SPOT program was initiated in 1978 by the French Government in cooperation with Belgium and Sweden, and is managed by the French Space Agency (CNES). The first in a series of SPOT satellites will be launched in 1985. SPOT's High Resolution Visible (HRV) imaging instruments provide for 10m resolution panchromatic and 20m multispectral imagery and the ability to look cross-track up to 27 degrees off nadir to allow for stereoscopic observations and improved accessibility. The spacecraft are operated by CNES which owns the data copyright. The SPOT data distribution is carried out on a commercial basis by SPOT IMAGE. The ground system includes a network of regional receiving stations, all of which contribute to a central data bank managed by SPOT IMAGE. Data are distributed by national or regional receiving stations, licensed distributors, and SPOT IMAGE subsidiary corporations. The policy for data dissemination is non-discriminatory both for 20m and 10m resolution images. Competition in the production and distribution of value-added SPOT products is anticipated and encouraged. Author

A86-28465

EARTH OBSERVATION SATELLITES - FROM TECHNOLOGY PUSH TO MARKET PULL

G. BRACHET (SPOT Image, Toulouse, France) IN: Space: The commercial opportunities; Proceedings of the International Business Strategy Conference, Londpn, England, October 31, November 1, 1984 . Pinner, England, Online Publications, 1984, p. 165-183.

The present trend towards commercial operation of high resolution observation satellites of the earth's surface will have a profound effect on the market for remote sensing data as well as on the industry for data enhancement and interpretation. The present situation is described, including satellites programs planned for the medium term, and the role of hardware, software and service industry is stressed. Author

N86-16896# Committee on Science and Technology (U. S. House).

LANDSAT COMMERCIALIZATION

Washington GPO 1985 84 p Hearing before the Comm. on Sci. and Technol., 99th Congr., 1st Sess., No. 30, 13 Jun. 1985
(GPO-49-336) Avail: Subcommittee on Natural Resources, Agriculture Research and Environment and Subcommittee on Space Science and Applications

Hearings were held in the U.S. House of Representatives by the Subcommittee on Natural Resources, Agriculture Research and Environment, and the Subcommittee on Space Science and application on the commercialization of the LANDSAT Program. The goal was to establish a commercial U.S. civil operation land-observing satellite program. E.A.K.

N86-17830# International Training Centre for Aerial Survey, Enschede (Netherlands).

ACTIVITIES REPORT IN REMOTE SENSING TRAINING Annual Report, 1983

1983 36 p refs
Avail: NTIS HC A03/MF A01

International cooperation in training and research in photogrammetry; aerial photography; cartography; land resource surveys and rural development; Earth resources surveys; and urban surveys and human settlements analysis are described.
Author (ESA)

N86-18373# Joint Research Centre of the European Communities, Ispra (Italy).

THE JOINT RESEARCH COMMITTEE (JRC) PROGRAM ON REMOTE SENSING

S. R. GALLIDEPARATESI *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 141-150 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

The European Economic Communities' Program on Remote Sensing for 1984 to 1987 is oriented towards land and marine applications to contribute to the feasibility study and concept of an advanced information system for agriculture, and of an advanced coastal pollution monitoring system, both using satellite and/or aircraft remote sensing data to be integrated with conventional data. Projects are: Rural Land Use Applied to European Less Favored Areas; Food Agriculture Resources in Sahelian Countries; and Coastal Transport of Pollutants and Oil Characterization by Laser-induced Fluorescence. Exercices of oil detection at sea are organized. A feasibility study on the use of space remotely sensed data as an aid to management of natural disasters is outlined.
Author (ESA)

N86-18374# Royal Aircraft Establishment, Farnborough (England). National Remote Sensing Center.

EUROPEAN REMOTE SENSING: FUTURE NEEDS IN EDUCATION

R. K. BULLARD *In* ESA Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 151-156 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

The education of people in Europe in the subject remote sensing is discussed. The range of education should extend from primary to tertiary and beyond to the public at large. The promotional role of education is to bring remote sensing to public attention in a less formal way and to achieve this there is a need for wide publicity including the press, television, radio, articles in journals and newspapers, videos, books, and slide sets. The cost of promotion may be directly related to the product while the reaction and response to it from the media and the public interest depend partly on its continuing inclusion in National programs and the justification of its applications. Author (ESA)

N86-18379# European Space Agency, Paris (France).

SPACE STATION: ESA VIEWS ON REQUIREMENTS FOR EXPERIMENTAL AND OPERATIONAL EARTH OBSERVATION MISSIONS

G. DUCHOSSOIS *In its* Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 189-199 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

The requirements of spaceborne experimental and operational Earth observations are reviewed, and an unmanned polar platform element, composed preferably of two platforms in adequately phased orbits is recommended as part of the European contribution to the US Space Station. Possible configuration and resources capabilities for such platforms are provided, together with candidate payloads. Author (ESA)

N86-20183# Joint Publications Research Service, Arlington, Va.

INTERVIEW WITH COSMONAUTS KIZIM AND SOLOVYEV

G. I. VOROBYEV *In its* USSR Report: Space (JPRS-USP-86-001) p 63-70 13 Jan. 1986 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow, USSR), no. 2, Mar. - Apr. 1985 p 16-22
Avail: NTIS HC A03

An interview with Salyut-7 cosmonauts who completed a 237 day mission space is given. Spaceborne experiments in medicine, oceanography, astrophysics and mineral exploration are discussed. R.J.F.

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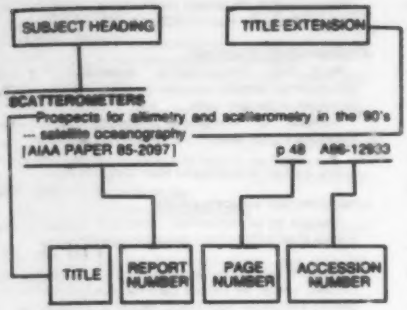

The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of the document content, the title extension is added, separated from the title by three hyphens. The (NASA or AIAA) accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

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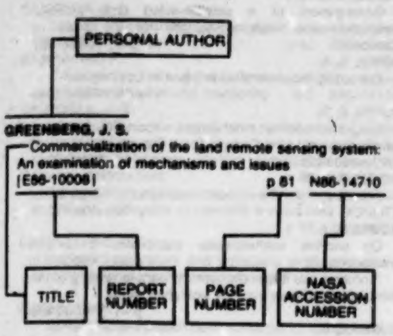

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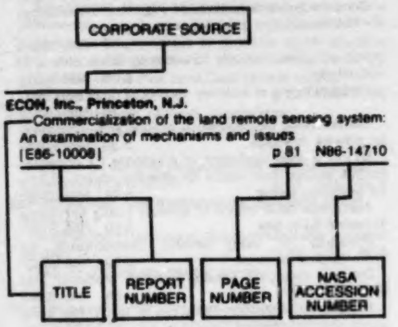
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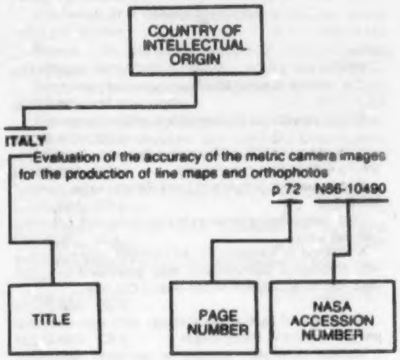
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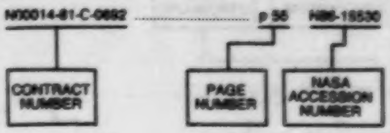

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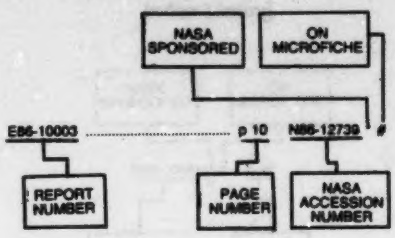

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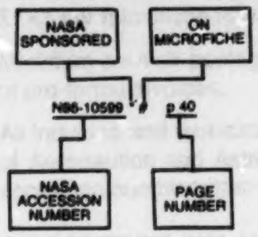

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NASA SP-7041(51)

EARTH RESOURCES

A CONTINUING BIBLIOGRAPHY WITH INDEXES

Issue 51

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between July 1 and September 30, 1986 in

- ***Scientific and Technical Aerospace Reports (STAR)***
- ***International Aerospace Abstracts (IAA).***

NASA Scientific and Technical Information Branch 1986
National Aeronautics and Space Administration
Washington, DC

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INTRODUCTION

The technical literature described in this continuing bibliography may be helpful to researchers in numerous disciplines such as agriculture and forestry, geography and cartography, geology and mining, oceanography and fishing, environmental control, and many others. Until recently it was impossible for anyone to examine more than a minute fraction of the Earth's surface continuously. Now vast areas can be observed synoptically, and changes noted in both the Earth's lands and waters, by sensing instrumentation on orbiting spacecraft or on aircraft.

This literature survey lists 382 reports, articles, and other documents announced between July 1 and September 30, 1986 in *Scientific and Technical Aerospace Reports (STAR)*, and *International Aerospace Abstracts (IAA)*.

The coverage includes documents related to the identification and evaluation by means of sensors in spacecraft and aircraft of vegetation, minerals, and other natural resources, and the techniques and potentialities of surveying and keeping up-to-date inventories of such riches. It encompasses studies of such natural phenomena as earthquakes, volcanoes, ocean currents, and magnetic fields; and such cultural phenomena as cities, transportation networks, and irrigation systems. Descriptions of the components and use of remote sensing and geophysical instrumentation, their subsystems, observational procedures, signature and analyses and interpretive techniques for gathering data are also included. All reports generated under NASA's Earth Resources Survey Program for the time period covered in this bibliography are also included. The bibliography does not contain citations to documents dealing mainly with satellites or satellite equipment used in navigation or communication systems, nor with instrumentation not used aboard aerospace vehicles.

The selected items are grouped in nine categories. These are listed in the Table of Contents with notes regarding the scope of each category. These categories were especially chosen for this publication, and differ from those found in *STAR* and *IAA*.

Each entry consists of a standard bibliographic citation accompanied by an abstract. The citations include the original accession numbers from the respective announcement journals.

Under each of the nine categories, the entries are presented in one of two groups that appear in the following order:

IAA entries identified by accession number series A86-10,000 in ascending accession number order;

STAR entries identified by accession number series N86-10,000 in ascending accession number order.

After the abstract section, there are seven indexes:

subject, personal author, corporate source, foreign technology, contract number, report/accession number, and accession number.

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TYPICAL REPORT CITATION AND ABSTRACT

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ACCESSION NUMBER → N86-12740*# Kansas Univ. Center for Research, Inc., Lawrence. ← CORPORATE SOURCE
Remote Sensing Lab.
TITLE → **EVALUATION OF SPACE SAR AS A LAND-COVER CLASSIFICATION Final Report**
AUTHORS → B. BRISCO, F. T. ULABY, and T. H. L. WILLIAMS 1985 ← PUBLICATION DATE 123 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
CONTRACT NUMBER → (Contract NCC9-7)
(E86-10004; NASA-CR-176267; NAS 1.26:176267; RSL-TR-605-1) ← REPORT NUMBERS
AVAILABILITY SOURCE → Avail: NTIS HC A06/MF A01 CSCL 02B ← COSATI CODE

The multidimensional approach to the mapping of land cover, crops, and forests is reported. Dimensionality is achieved by using data from sensors such as LANDSAT to augment Seasat and Shuttle Image Radar (SIR) data, using different image features such as tone and texture, and acquiring multidate data. Seasat, Shuttle Imaging Radar (SIR-A), and LANDSAT data are used both individually and in combination to map land cover in Oklahoma. The results indicates that radar is the best single sensor (72% accuracy) and produces the best sensor combination (97.5% accuracy) for discriminating among five land cover categories. Multidate Seasat data and a single data of LANDSAT coverage are then used in a crop classification study of western Kansas. The highest accuracy for a single channel is achieved using a Seasat scene, which produces a classification accuracy of 67%. Classification accuracy increases to approximately 75% when either a multidate Seasat combination or LANDSAT data in a multisensor combination is used. The tonal and textural elements of SIR-A data are then used both alone and in combination to classify forests into five categories. Author

TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

NASA SPONSORED

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AIAA ACCESSION NUMBER → A86-15606*# National Aeronautics and Space Administration, Washington, D.C.
TITLE → **BIOGEOCHEMICAL CYCLING IN TERRESTRIAL ECOSYSTEMS - MODELING, MEASUREMENT, AND REMOTE SENSING**
AUTHORS → D. L. PETERSON, P. A. MATSON, J. G. LAWLESS (NASA, Ames Research Center, Moffett Field, CA), J. D. ABER (Wisconsin, University, Madison), P. M. VITOUSEK (Stanford University, CA) ← AUTHOR'S AFFILIATION
et al. IAF, International Astronautical Congress, 36th, Stockholm, Sweden, ← MEETING
Oct. 7-12, 1985. ← MEETING DATE 13 p. refs
REPORT NUMBER → (IAF PAPER 85-14)

The use of modeling, remote sensing, and measurements to characterize the pathways and to measure the rate of biogeochemical cycling in forest ecosystems is described. The application of the process-level model to predict processes in intact forests and ecosystems response to disturbance is examined. The selection of research areas from contrasting climate regimes and sites having a fertility gradient in that regime is discussed, and the sites studied are listed. The use of remote sensing in determining leaf area index and canopy biochemistry is analyzed. Nitrous oxide emission is investigated by using a gas measurement instrument. Future research projects, which include studying the influence of changes on nutrient cycling in ecosystems and the effect of pollutants on the ecosystems, are discussed. I.F.

EARTH RESOURCES

A Continuing Bibliography (Issue 51)

OCTOBER 1986

01

AGRICULTURE AND FORESTRY

Includes crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventry, forest fire detection, and wildlife migration patterns.

A86-29843
AGRICULTURAL AND SCIENTIFIC SPACE PLATFORMS [NARODNOKHOZIAISTVENNYE I NAUCHNYE KOSMICHESKIE KOMPLEKSY]
V. S. AVDUEVSKII and G. R. USPENSKII Moscow, Izdatel'stvo Mashinostroenie, 1985, 416 p. In Russian. refs

The agricultural and scientific applications of remote sensing platforms in space are discussed, with emphasis given to Soviet Meteor and Salyut programs. The physical principles of a number of remote sensing instruments are briefly described, including lidar, SAR, microwave radiometry, and infrared photography. Numerical techniques for classifying remote sensing data according to the physical characteristics of the object (water, forest land, agricultural areas) are also described. Organizational diagrams describing a typical remote sensing system for agricultural applications are provided. I.H.

A86-30190
MICROWAVE REMOTE SENSING OF AGRICULTURAL CROPS IN CANADA
J. CIHLAR, R. J. BROWN, and B. GUINDON (Canada Centre for Remote Sensing, Ottawa) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Feb. 1986, p. 195-212. refs

The objective of this paper is to review current knowledge concerning synthetic aperture radar applications to crops in Canada. Following a brief overview of studies during SURSAT (1978-1980) and RADARSAT (1981 and later) projects, several issues are considered. These include crop-classification accuracies achieved with SAR or SAR and VIR data at various sites, the importance of crop and soil parameters affecting SAR images, the procedures for digital SAR image analysis and the relationship between airborne SAR data and future satellite SAR data. Finally, recent developments of new ground and airborne microwave instruments to be used in agricultural studies are described. Author

A86-30191
MONOTEMPORAL, MULTITEMPORAL, AND MULTIDATE THERMAL INFRARED DATA ACQUISITION FROM SATELLITES FOR SOIL AND SURFACE-MATERIAL SURVEY
D. W. LYNN (Reading, University, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Feb. 1986, p. 213-231. refs

With the improvement in spatial resolution of thermal sencors over the past decade the employment of thermal infrared satellite data for soil and surface-material survey has become increasingly attractive. The individual orbital characteristics of each satellite provide the opportunity of acquiring monotemporal (same day, one time), multitemporal (same day, different times) and multidate (different days, same time) imagery. The time at which such imagery is acquired is of great importance since the emitted thermal response of any natural material is a function not only of the material's emissivity, but also of its temperature at the time of imaging. The implications of acquiring monotemporal, multitemporal and multidate thermal infrared data are discussed in relation to thermal sensors in past, current and future satellites. Author

A86-30192
DIURNAL PATTERNS OF BIDIRECTIONAL VEGETATION INDICES FOR WHEAT CANOPIES
M. SHIBAYAMA, C. L. WIEGAND, and A. J. RICHARDSON (USDA, Agricultural Research Service, Weslaco, TX) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Feb. 1986, p. 233-246. refs

Solar altitude effects on the perpendicular vegetation index (PVI) and normalized difference vegetation index (NDVI) are examined. Spectral data of two canopies of hard, red spring wheat was collected at A.R.S. South Research Farm in Weslaco, Texas in 1984. Leaf area index (LEA) was measured over plant development and ranged from 4.0-2.5. PVI and NDVI were calculated from radiometer RED (0.63-0.69 microns) and NIR (0.76-0.90 microns) bidirectional radiance observations of wheat canopies; the equation for calculating common solar irradiance (PVIC) from PVI is given. It is observed that PVIC at nadir view increases as the solar zenith angle increases; however, the NDVI remains unchanged. The off-nadir to nadir PVIC ratio increases as the view zenith and solar zenith angles increase and the NDVI is unaffected. It is concluded that PVI, though subjected to bidirectional effects, provides more useful data about wheat canopies at LAI greater than two than does NDVI. I.F.

A86-30193* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ASSESSING IMPACTS OF OFF-NADIR OBSERVATION ON REMOTE SENSING OF VEGETATION - USE OF THE SUITS MODEL
D. S. BARTLETT, R. W. JOHNSON (NASA, Langley Research Center, Hampton, VA), M. A. HARDISKY, and V. KLEMAS (Delaware, University, Newark) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Feb. 1986, p. 247-264. NASA-supported research. refs

The use of Suits' (1972a, b) digital radiative transfer model to simulate the effect of nonLambertian canopy reflectance on off-nadir observations of vegetation is discussed. Canopy reflectances of cord grass are calculated using the radiative transfer model, field radiometric measurements, and airborne multispectral scanner data. The effects of varying view angles on canopy reflectance are analyzed and compared. The comparison reveals that the model is effective in simulating the sense and magnitude of reflectance change due to variable angles of observations; however, the model does not reproduce the observed dependence of nadir canopy reflectance on solar zenith angle. It is concluded that the radiative transfer model is applicable for predicting the variation in canopy reflectance due to changing view zenith angles. I.F.

A86-30194* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SATELLITE-DERIVED LEAF-AREA-INDEX AND VEGETATION MAPS AS INPUT TO GLOBAL CARBON CYCLE MODELS - A HIERARCHICAL APPROACH

G. D. BADHWAR, R. B. MACDONALD (NASA, Johnson Space Center, Houston, TX), and N. C. MEHTA (MIT, Lexington, MA) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Feb. 1986, p. 265-281. refs

A hierarchical procedure for developing a leaf area index (LAI) map of deciduous boreal forests is studied. The collection of spectral reflectance data from the Boundary Waters Canoe area in Minnesota using helicopter-, high-altitude aircraft-, and Landsat-mounted spectral sensors is described. The relationship between LAI and biomass and the reflectance ratio is analyzed. The sensitivity of canopy reflectance in the visible and infrared to the LAI of the canopy for various boreal forest species is evaluated. The data reveal that Landsat data are useful for producing LAI maps of deciduous forest areas and the maps provide data which clarifies the function of vegetation in the global carbon cycle models. I.F.

A86-30196

THE INFLUENCE OF OBSERVATIONAL INTERDEPENDENCE ON SPECTRAL REFLECTANCE RELATIONSHIPS WITH PLANT AND SOIL VARIABLES

W. J. RIPPLE, B. J. SCHRUMPF, and D. L. ISAACSON (Oregon State University, Corvallis) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Feb. 1986, p. 291-294. refs

The relationships between spectral reflectance and plot variables in a desert shrub community were studied by repeated observation as biomass was removed from 2.93 sq m plots. As a result of these repeated observations, interdependence effects were present in the data sets. The spectral/plot relationships were discovered to be weaker with the removal of this observational interdependence. Middle infrared reflectance (2.08-2.35 microns) was found to account for more of the variation in the group of plot variables than did reflectance in the other spectral regions tested, and the variable of total moisture was best for explaining the variability of the spectral data. Author

A86-30197

VEGETATION INDEX AND POSSIBILITY OF COMPLEMENTARY PARAMETERS FROM AVHRR/2

S. M. SINGH (Reading, University, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Feb. 1986, p. 295-300.

The data from the Advanced Very High Resolution Radiometer are used for calculating atmospherically corrected temperature difference in the split-window channels, the normalized difference vegetation index and the spectral reflectance at channel-1 wavelength. An illustration is presented which shows that when there is significant change (larger than the inherent accuracy) in any one of these three quantities, the other two quantities also change. This qualitative inference indicates the possibility that these three parameters may complement each other. Author

A86-30198

A TEXTURE-ENHANCEMENT PROCEDURE FOR SEPARATING ORCHARD FROM FOREST IN THEMATIC MAPPER DATA

D. K. GORDON and W. R. PHILIPSON (Cornell University, Ithaca, NY) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Feb. 1986, p. 301-304.

(Contract USDA-58-319T-3-0208X)

A procedure is described for automatically separating temperate fruit tree orchards from mixed deciduous forest in Landsat Thematic Mapper data. A filter is applied to enhance the texture of bands 4 and 3 prior to ratioing, smoothing, and level-slicing to a binary image on the basis of supervised training. Including the binary image in supervised classification of single data imagery has reduced misclassification of forest as orchard from 75 percent of the forest pixels to fewer than 7 percent. Author

A86-32684

DETERMINATION OF THE MOISTURE CONTENT OF NONUNIFORMLY MOISTENED SOILS WITH A SURFACE TRANSITION LAYER ON THE BASIS OF MICROWAVE SPECTRORADIOMETRY [OPREDELENIE VLAZHNOSTI NEODNORODNO UVLAZHNENNYKH POCHVOGRUNTOV S POVERKHNOSTNYM PEREKHODNYM SLOEM PO DANNYM SPEKTRAL'NYKH SVCH-RADIOMETRICHESKIKH IZMERENII]

E. A. REUTOV and A. M. SHUTKO (AN SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1986, p. 71-78. In Russian. refs

A86-32689

FORMATION OF A DIGITAL DATA BASE FOR AUTOMATED FOREST MAPPING [FORMIROVANIE TSIFROVOI BAZY DANNYKH PRI AVTOMATIZIROVANNOM KARTOGRAFIROVANII LESOV]

E. D. BODANSKII, D. A. STAROSTENKO, and R. I. ELMAN (Vsesoiuznoe Aerofotolesoustroitel'noe Ob'edinenie Lesproekt, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1986, p. 104-110. In Russian.

The paper examines the content and structure of a digital forest-mapping database, consistent with the content and structure of maps automatically compiled from space remote-sensing images. It is shown how graphic data, in raster and vector formats, can be represented in digital form. The concepts of an elementary graphic feature, a graphic fragment, and a mapping generator are described. B.J.

A86-33503* Department of Agriculture, Washington, D.C.

OVERVIEW OF THE AGRISTARS RESEARCH PROGRAM. I

C. E. CAUDILL (USDA, Statistical Reporting Service, Washington, DC) and R. E. HATCH (NASA, Washington, DC) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 9-16.

An account is given of the activities and accomplishments to date of the U.S. Department of Agriculture's Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing (AgRISTARS) program, which is a cooperative venture with NASA and the Departments of the Interior and of Commerce. AgRISTARS research activities encompass early warning and crop condition assessment, inventory technology development for production forecasting, crop yield model development, soil moisture monitoring, domestic crops and land cover sensing, renewable resources inventory, and conservation and pollution assessment. O.C.

A86-33504* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PASSIVE MICROWAVE SOIL MOISTURE RESEARCH

T. J. SCHMUGGE, P. E. ONEILL, and J. R. WANG (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 20-25. refs

The AgRISTARS Soil Moisture Project has made significant progress in the quantification of microwave sensor capabilities for soil moisture remote sensing. The 21-cm wavelength has been verified to be the best single channel for radiometric observations of soil moisture. It has also been found that other remote sensing approaches used in conjunction with L-band passive data are more successful than multiple wavelength microwave radiometry in this application. AgRISTARS studies have also improved current understanding of noise factors affecting the interpretability of microwave emission data. The absorption of soil emission by vegetation has been quantified, although this effect is less important than absorption effects for microwave radiometry. O.C.

A86-33506* National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.

REMOTE SENSING TECHNIQUES FOR THE DETECTION OF SOIL EROSION AND THE IDENTIFICATION OF SOIL CONSERVATION PRACTICES

R. E. PELLETIER (NASA, National Space Technology Laboratories, Bay St. Louis, MS) and R. H. GRIFFIN (USDA, Fort Worth, TX) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 40-45. refs

The following paper is a summary of a number of techniques initiated under the AgRISTARS (Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing) project for the detection of soil degradation caused by water erosion and the identification of soil conservation practices for resource inventories. Discussed are methods to utilize a geographic information system to determine potential soil erosion through a USLE (Universal Soil Loss Equation) model; application of the Kauth-Thomas Transform to detect present erosional status; and the identification of conservation practices through visual interpretation and a variety of enhancement procedures applied to digital remotely sensed data. Author

A86-33523* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

RADAR SCATTEROMETER PROBING OF THICK VEGETATION CANOPIES

J. F. PARIS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 161-163.

A86-33524

ESTIMATION OF THE WEIGHT OF VEGETATION USING MICROWAVE TRANSMISSION MEASUREMENTS

W. L. STUTZMAN (Virginia Polytechnic Institute and State University, Blacksburg) and H. S. CRAWFORD (U.S. Forest Service, Orono, ME) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 164-167. refs

Fast, accurate estimation of vegetation weight using microwave transmission measurements is reported, with application to the propagation problem arising in communication. Field tests at 12.25 GHz in 1976 using a 5-m path two first-Fresnel zones wide (35 cm), and one with a cell width of two second-Fresnel zones (49.5 cm), were performed at a site in Virginia containing mostly Virginia pine regrowth. The attenuation least polarized and then compensated for polarization mismatch was found to correlate well with oven-dry weight of vegetation having stems less than 1.25 cm in diameter. Correlation of vegetation to attenuation in controlled field tests from 1977 to 1979 in Maine was significant, though not as good as in previous tests. Results from random sampling testing show similar regeneration coefficients of signal loss to vegetation weight to those of the controlled tests. R.R.

A86-33525* National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.

A PRELIMINARY REPORT ON THE MEASUREMENTS OF FOREST CANOPIES WITH C-BAND RADAR SCATTEROMETER AT NASA/NSTL

S. T. WU (NASA, National Space Technology Laboratories, Bay St. Louis, MS) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 168-173.

This paper presents preliminary results of C-band radar scatterometer measurements of forest canopies of southeastern forests in the vicinity of NASA/NSTL. The results are as follows: (1) the radar backscattering coefficients (BSC) of deciduous forests such as oak, maple, blackgum, and cypress are higher than those of coniferous forests such as slash pine plantation and natural pine; (2) at a large incidence angle, where polarization effect is significant, and by ranging measurement, the VV polarization BSC obtain peak value at the first few meters from the canopy top and decrease rather quickly, while the HH polarization BSC obtain peak value at longer distances from the canopy top and decrease rather slowly through the canopy; and (3) using the active radar calibrator for tree canopy attenuation measurement of a dense and a sparse live oak, it is found that the tree canopies with higher attenuations have higher BSC for all three polarizations, with VV polarization containing the largest differential (2.2 dB). Author

A86-33538

ONE STEP ABOVE GROUND TRUTH - AIRPHOTO KEYS FOR LARGE-SCALE VEGETATION ANALYSIS

W. BEFORT (New Hampshire, University, Durham) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 278-283. refs

The major requirements for producing an effective pictorial airphoto vegetation key, i.e., a pictorial set of reference material for rapid and accurate analysis of aerial photographs, are discussed. Consideration is given to the reproduction of color stereogram and to the identification and grouping of species, as well as to the cost, publication form, and durability of the key. A modular layout is suggested, which would facilitate making additions and improvements incrementally, without revising the entire work. Publishing the key as a looseleaf, rather than a bound book would enaibe the user to purchase, in addition to the basic set of pages, only the pages that would suit his specific requirements. Moreover, damaged pages could be replaced individually, and the pages needed in the field could be laminated. I.S.

A86-33539

A CORRELATION AND REGRESSION ANALYSIS OF PRECENT CANOPY CLOSURE VS. TMS SPECTRAL RESPONSE FOR SELECTED FOREST SITES IN THE SAN JUAN NATIONAL FOREST, COLORADO

M. K. BUTERA (Science Applications International Corp., Washington, DC) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronic Engineers, Inc., 1985, p. 287-302. refs

This investigation tested the correlation of canopy closure with the signal response of individual Thematic Mapper Simulator (TMS) bands for selected forest sites in the San Juan National Forest, Colorado. Ground truth consisted of a photointerpreted determination of percent canopy closure of 0 to 100 percent for 32 sites. The sites selected were situated on plateaus at an elevation of approximately 3 km with slope not greater than 10 percent. The predominant tree species were ponderosa pine and aspen. The mean TMS response per band site was calculated from data acquired by aircraft during mid-September 1981. A correlation analysis of TMS response vs canopy closure resulted in the following correlation coefficients for bands 1 through 7, respectively: -0.757, -0.663, -0.666, -0.088, -0.797, -0.597, -0.763. Two model regressions were applied to the TMS data set to create a map of predicted percent forest canopy closure for the study area. Results indicated percent predictive accuracies of 71, 74, and 57 for percent canopy closure classes of 0-25, 25-75, and 75-100, respectively. Author

A86-33540* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ANALYSIS OF FOREST/STRUCTURE USING THEMATIC MAPPER SIMULATOR DATA

D. L. PETERSON, J. A. BRASS (NASA, Ames Research Center, Moffett Field, CA), W. E. WESTMAN, V. G. AMBROSIA, M. A. SPANNER (NASA, Ames Research Center; Technicolor Government Services, Inc., Moffett Field, CA) et al. IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 305-309.

A86-33541* Hunter Coll., New York.

CALIFORNIA TIMBER VOLUME INVENTORY USING LANDSAT

A. H. STRAHLER (Hunter College, New York) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 310-312. Research supported by the U.S. Forest Service and California Institute of Technology.
(Contract NAS9-15509; NAS7-100; USDA-53-9158-0-6362)

A86-33542* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

ESTIMATION OF BIOPHYSICAL PROPERTIES OF FOREST CANOPIES THROUGH INVERSION OF MICROWAVE SCATTEROMETER DATA

D. E. PITTS, G. D. BADHWAR (NASA, Johnson Space Center, Houston, TX), and E. RAYNA (Lockheed Engineering and Management Services Co., Inc., Houston, TX) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 313-320.

A method for estimating the biophysical properties of a forest canopy through inversion of microwave scatterometer data is discussed. A C-band scatterometer flown over an aspen site in northern Minnesota during 19 days from May 2 to October 20, 1984, was modified to enable continuous recording of the range of the target. This provided the backscatter cross section as a function of range and was used to study scattering processes within the canopy. The remote estimates of HH, VV, and HV extinction coefficient values agreed well with the estimates obtained with the use of an active radar calibrator. I.S.

A86-33554* California Inst. of Tech., Pasadena.

MODELLING OF BACKSCATTER FROM VEGETATION LAYERS

J. J. VAN ZYL, N. ENGHETA, C. H. PAPAS (California Institute of Technology, Pasadena), C. ELACHI, and H. ZEBKER (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 389-398. refs

A simple way to build up a library of models which may be used to distinguish between the different types of vegetation and ground surfaces by means of their backscatter properties is presented. The curve of constant power received by the antenna (Gamma sphere) is calculated for the given Stokes Scattering Operator, and model parameters are adopted of the most similar library model Gamma sphere. Results calculated for a single scattering model resembling coniferous trees are compared with the Gamma spheres of a model resembling tropical region trees. The polarization which would minimize the effect of either the ground surface or the vegetation layer can be calculated and used to analyze the backscatter from the ground surface/vegetation layer combination, and enhance the power received from the desired part of the combination. R.R.

A86-33555

BACKSCATTER MEASUREMENTS FROM SIMULATED RESONANT STRUCTURES

D. F. ZOOK and R. J. BLANCHARD (Texas, University, Arlington) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 399-404.

A simulation is performed to test the hypothesis that higher nodal dielectric constants in the stalks caused by additional moisture were responsible for increased radar backscatter cross sections in standing corn late in the season. Measurements at L-band were made of 2.5 relative permitivity PUC pipe with metal rings to simulate the moisture laden nodes, using a 20-MHz short pulse radar polarimeter system. Simulation target data from nodal lengths of 0.8, 1.0, and 1.2 wavelengths revealed that the nodal spacing backscatter is dependent on the volume density as well as the nodal spacing of stalk structures. The similarity in the number of scatterers between the rings-only experiments and other experiments suggests that an additional phenomenon must be accounting for the increase in backscatter. R.R.

A86-33556* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

NEAR INFRARED LEAF REFLECTANCE MODELING

J. B. PARRISH (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 405-409. refs

Near infrared leaf reflectance modeling using Fresnel's equation (Kumar and Silva, 1973) and Snell's Law successfully approximated the spectral curve for a 0.25-mm turgid oak leaf lying on a Halon background. Calculations were made for ten interfaces, air-wax, wax-cellulose, cellulose-water, cellulose-air, air-water, and their inverses. A water path of 0.5 mm yielded acceptable results, and it was found that assignment of more weight to those interfaces involving air versus water or cellulose, and less to those involving wax, decreased the standard deviation of the error for all wavelengths. Data suggest that the air-cell interface is not the only important contributor to the overall reflectance of a leaf. Results also argue against the assertion that the near infrared plateau is a function of cell structure within the leaf. R.R.

A86-33557

LIGHT INTERCEPTION AND LEAF AREA ESTIMATES FROM MEASUREMENTS OF GRASS CANOPY REFLECTANCE

G. ASRAR and E. T. KANEMASU (Kansas State University of Agriculture and Applied Science, Manhattan) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 412-417. refs

A procedure for estimating intercepted photosynthetically active radiation (PAR) and the green leaf area index (LAI) from measurements of grass canopy was developed. Spectral measurements were conducted throughout the entire season on the Konza Prairie Research Natural Area (Kansas), using a truck-mounted assembly equipped with Exotech model 100-A and Barnes Modular Multispectral model radiometers. Empirical linear regression equations were derived, based on a simple radiative transfer model and direct field measurements, that can be used to estimate p (the mean daily PAR fraction, corrected for the reflected and transmitted components) from measurements of canopy reflectance by the radiometers that mimic the MSS and TM sensor systems on board Landsat satellites. I.S.

A86-33558

CLASSIFICATION OF SOUTH TEXAS FARM AND RANGE RESOURCES USING NOAA7 AVHRR SATELLITE IMAGERY

A. J. RICHARDSON and J. H. EVERITT (USDA, Agricultural Research Service, Weslaco, TX) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 418-425. refs

Polar orbiting meteorological satellite scenes from October 1981 to July 1982 were used to classify south Texas farm and range plant communities using the NOAA7 advanced very high resolution radiometer (AVHRR). Classification results were related to maps of south Texas that contained information about soil, crop, and agronomic resources, and to agronomic resource expertise of local scientists. A table look-up procedure, based on reflective bands 1 and 2, was used to automatically classify AVHRR data into cloud, water, bare soil, and vegetation vigor levels (low, medium, and high). These classified results were found to be related to prominant level I farm and range resources such as oak (Quercus spp) trees, improved grasses, unimproved rangeland, dryland cotton and sorghum farming areas, and irrigated cotton and sorghum farming areas. Author

A86-33565* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

FOREST DISCRIMINATION WITH MULTIPOLARIZATION IMAGING RADAR

J. P. FORD and D. E. WICKLAND (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 462-465. NASA-supported research.

The use of radar polarization diversity for discriminating forest canopy variables on airborne synthetic-aperture radar (SAR) images is evaluated. SAR images were acquired at L-Band (24.6 cm) simultaneously in four linear polarization states (HH, HV, VH, and VV) in South Carolina on March 1, 1984. In order to relate the polarization signatures to biophysical properties, false-color composite images were compared to maps of forest stands in the timber compartment. In decreasing order, the most useful correlative forest data are stand basal area, forest age, site condition index, and forest management type. It is found that multipolarization images discriminate variation in tree density and difference in the amount of understory, but do not discriminate between evergreen and deciduous forest types. R.R.

A86-33566* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

FOREST DISCRIMINATION WITH MULTIPOLARIZATION IMAGING RADAR

J. P. FORD and D. E. WICKLAND (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 466-469. NASA-supported research.

The relations between polarization signatures and biophysical characteristics through a range of different forest environments were investigated using airborne synthetic-aperture (SAR) images acquired at L-band on March 1, 1984 in South Carolina. SAR data acquired in four linear polarization states with 10-m spatial resolution were encoded as color composite images and compared to US Forest Service forest stand data. The most useful correlative forest data were stand basal area, forest age, site condition index, and forest management type. It is found that the multipolarization images discriminate variation in tree density or difference in the amount of understory, but no evidence has been found for discrimination between evergreen and deciduous forest types. R.R.

A86-33576* Agricultural Research Service, Houston, Tex.

OVERVIEW AND HIGHLIGHTS OF EARLY WARNING AND CROP CONDITION ASSESSMENT PROJECT

G. O. BOATWRIGHT (USDA, Agricultural Research Service, Houston, TX) and V. S. WHITEHEAD (NASA, Johnson Space Center, Houston, TX) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 537-546. refs

Work of the Early Warning and Crop Condition Assessment (EW/CCA) project, one of eight projects in the Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing (AgRISTARS), is reviewed. Its mission, to develop and test remote sensing techniques that enhance operational methodologies for crop condition assessment, was in response to initiatives issued by the Secretary of Agriculture. Meteorologically driven crop stress indicator models have been developed or modified for wheat, maize, grain sorghum, and soybeans. These models provide early warning alerts of potential or actual crop stresses due to water deficits, adverse temperatures, and water excess that could delay planting or harvesting operations. Recommendations are given for future research involving vegetative index numbers and the NOAA and Landsat satellites. D.H.

A86-33577* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

VEGETATION ASSESSMENT USING A COMBINATION OF VISIBLE, NEAR-IR AND THERMAL-IR AVHRR DATA

V. S. WHITEHEAD (NASA, Johnson Space Center, Houston, TX), W. JOHNSON, and J. BOATRIGHT (Lockheed Engineering and Management Services Co., Inc., Houston, TX) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 548-555. refs

Twelve hour temperature difference (thermal inertia) maps generated by rectifying and registering ascending (day) passes and descending (night) passes of the NOAA-7 Advanced Very High Resolution Radiometer (AVHRR) are compared to vegetation index maps generated from the visible and near IR data from the day pass of that satellite. There appears to be significant and unique information concerning surface characteristics in the temperature difference data on the 1 km scale of the AVHRR. A scatter diagram is provided which shows the pattern of day-night temperature difference compared to vegetation index for irrigated agriculture, dry rangeland, lakes, wet areas and burned rangeland. A detailed description of the techniques employed to provide the day-night temperature maps is provided. Author

A86-33578

DETECTION AND EVALUATION OF PLANT STRESSES FOR CROP MANAGEMENT DECISIONS

R. D. JACKSON, P. J. PINTER, JR., R. J. REGINATO, and S. B. IDSO (USDA, Water Conservation Laboratory, Phoenix, AZ) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 556-561. refs

It is suggested that the ability to quantitatively assess crop conditions using remotely sensed data would not only improve yield forecasts but would also provide information that would be useful to farm managers in making day-to-day management decisions. Experiments were conducted using ground based radiometers to relate spectral response to crop canopy characteristics. It was found that radiometrically measured crop temperature, when compared with a reference temperature, was related to the degree of plant stress and could indicate the onset of stress. Timeliness, frequency of coverage, and resolution are three factors that must be considered when satellite based sensors are used to evaluate crop conditions for farm management applications. D.H.

A86-33579

DEVELOPMENT OF AGROMETEOROLOGICAL CROP MODEL INPUTS FROM REMOTELY SENSED INFORMATION

C. L. WIEGAND, A. J. RICHARDSON (USDA, Agricultural Research Service, Weslaco, TX), R. D. JACKSON, P. J. PINTER, JR. (USDA, Agricultural Research Service, Phoenix, AZ), J. K. AASE (USDA, Agricultural Research Service, Sidney, MT) et al. IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 564-569.

Efforts at developing agrometeorological crop model inputs from remotely sensed information (AgRISTARS Early Warning/Crop Condition Assessment Project Subtask 5 within USDA) are described. Much effort has gone into developing measurement and interpretation skill, convincing the scientific community of the validity and information content of the spectral measurements, and providing new understanding of the crop scenes viewed as affected by bidirectional, atmospheric, and soild background variations. Vegetation indices are an excellent measure of the amount of green photosynthetically active tissue present in plant stands at any time during the season. They can reliably estimate leaf area index and intercepted photosynthetically active radiation. Newness of the spectral interpretations, combined with continual revisions in the agrometeorological models and lack of feedback capability in them, have prevented the benefits of spectral inputs to agrometeorological models from being fully realized. D.H.

A86-33582

POSSIBLE APPLICATIONS OF THE MICROWAVES SURFACE SOIL MOISTURE REMOTE SENSING

R. BERNARD and D. VIDAL-MADJAR (Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Issy-les-Moulineaux, France) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 594-600. CNES-supported research. refs

With the development of airborne scatterometers and of microwaves radiometers, it is now possible to map the soil surface water content and its short or long term time variation. It is shown here that this parameter is meaningful to describe the vertical soil water movement in the unsaturated zone and that it can also be used to estimate the drainage properties of bare soils surface. Author

A86-33583* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

AN AIRBORNE MULTIPLE-BEAM 1.4 GHZ PUSHBROOM MICROWAVE RADIOMETER

R. F. HARRINGTON and R. W. LAWRENCE (NASA, Langley Research Center, Hampton, VA) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 601-606.

A method is described for providing soil moisture measurements from satellites by performing simultaneous measurements across track (the pushbroom approach). The method has the advantage of obtaining the required swath width without sacrificing sensitivity. A prototype Pushbroom Microwave Radiometer developed at NASA's Langley Research Center is described. It is a multibeam L-Band (1413 MHz) radiometer system providing simultaneous cross track measurements. Results of flight tests onboard a P-3 aircraft are discussed. D.H.

A86-33598

SURFACE MATERIAL CLASSIFICATION BASED ON SPECTRAL SHAPE

M. J. CARLOTTO and V. T. TOM (Analytic Sciences Corp., Reading, MA) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 703-708. refs

A method for classifying surface material classes, based on the shape of the spectral signature, is presented. Spectral shape is described in terms of a vector of predicates which specify the relative intensities between all pairs of bands. Spectral signatures are represented as logical expressions of shape predicates which define the classification logic. Preliminary results for Landsat TM image classification are discussed. D.H.

A86-33605

USDA/SRS SOFTWARE FOR LANDSAT MSS-BASED CROP-ACREAGE ESTIMATION

M. OZGA (USDA, Statistical Reporting Service, Washington, DC) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 762-772. refs

A description is given of a large software system, known as EDITOR, developed by the Statistical Reporting Service of the USDA to aid in crop acreage estimation. EDITOR is a collection of independent programs operating on data in many different files. Most EDITOR programs are called using relatively simple commands from a main program. Topics covered include: the history and development of EDITOR; the structure and major functions; supercomputer usage; and computer configuration for EDITOR processing. PEDITOR (portable EDITOR) has been developed for use with the smaller machines - including microcomputers - coming into use. To continue to be useful with new types of data, such as Thematic Mapper and SPOT, and the new computers, EDITOR will have to be adapted. D.H.

A86-33606* Houston Univ., Clear Lake, Tex.

EVALUATION OF CROP ACREAGE ESTIMATION METHODS USING LANDSAT DATA AS AUXILIARY INPUT

R. S. CHHIKARA (Houston, University, Clear Lake, TX), A. G. HOUSTON (NASA, Johnson Space Center, Houston, TX), and J. C. LUNDGREN (Lockheed Engineering and Management Services Co., Houston, TX) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 778-785. USDA-supported research. refs

(Contract NAS9-15800)

The regression and ratio estimators are studied in the context of improving upon the ground survey estimates of crop acreages by utilizing Landsat data. The approach is to formulate analytically the estimation problem that utilizes ground survey data, as collected by the U.S. Department of Agriculture, and Landsat data, which provide a complete coverage for an area of interest, and then to conduct simulation studies. It is shown over a wide range of conditions that the regression estimator is the most efficient unless there is a low correlation between the actual and estimated crop acreages in the sampled area segments, in which case a ratio type estimator is superior. Estimation of the variance of the regression estimator is also investigated. Author

A86-33622

NONPARAMETRIC MODELS AND CROP CLASSIFICATION

M. L. ARMSTRONG and I. E. ABDOU (Delaware, University, Newark) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 892-897. refs

The performance of a nonparametric classifier is compared with that of a Gaussian classifier. Two measures of performance are used: the chi-squared goodness-of-fit test, and the classification error. The data set used is a Landsat multispectral scanner image, and the classes of interest are corn/soybean fields. The results show that although the Gaussian model did not satisfy the goodness-of-fit measure, the overall classification performance was good. Another conclusion is that the nonparametric classifier error is comparable to the Gaussian error, with more room for improvement. Author

A86-33625

SAR IMAGE SEGMENTATION USING DIGITISED FIELD BOUNDARIES FOR CROP MAPPING AND MONITORING APPLICATIONS

M. G. WOODING (Royal Aircraft Establishment, U.K. National Remote Sensing Centre, Farnborough, England) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 912-918.

An approach to SAR image segmentation (so that areas can be analyzed as separate units) is presented, based on the digitizing of field boundaries from large scale maps and the geometric transformation of SAR images. Following the registration of maps and images, techniques are used for automated backscatter measurement and the generation of segmented images. The approach is seen to be particularly valuable for experimental work in general and for operational crop monitoring. The UK Ordnance Survey has long term plans to digitize fully the preparation of its maps and this could eventually be an important data source of field boundary maps for large area crop mapping. Plans have been made to have a facility to edit field boundaries on a display of the field boundary map superimposed on the image. A segmented image database system is to be developed to exploit and extend the analysis possibilities created by image segmentation. D.H.

A86-33627

SPECTRAL COMPONENTS ANALYSIS - A BRIDGE BETWEEN SPECTRAL OBSERVATIONS AND AGROMETEOROLOGICAL CROP MODELS

C. L. WIEGAND, A. J. RICHARDSON, and P. R. NIXON (USDA, Agricultural Research Service, Weslaco, TX) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 941-946. refs

Two experiments are described that were conducted under AgRISTARS sponsorship, one with cotton and one with spring wheat, specifically to determine the relationships for each term in the 'spectral components analysis' identity, LAI/VI x APAR/LAI = APAR/VI. LAI is leaf area index; VI is vegetation index; and APAR is absorbed photosynthetically active radiation. LAI and APAR were well estimated from vegetation indices such as normalized difference and perpendicular vegetation index. The spectral components analysis results presented lend credence to the information conveyed by spectral canopy observations about plant development and yield, and establish a bridge between remote observations and agrometeorological crop modeling through the variables of mutual concern: LAI, light absorption, and yield. D.H.

A86-33628

COMPARISON BETWEEN LANDSAT MSS AND THEMATIC MAPPER DATA FOR GEOBOTANICAL PROSPECTING IN THE SPANISH-PORTUGUESE PYRITE BELT

C. BANNINGER (Graz, Technische Universitaet und Forschungszentrum; Institut fuer Digitale Bildverarbeitung und Graphik, Austria) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 949-956. refs

Landsat MSS and Thematic Mapper data successfully detected metal-related stress in a pine tree stand growing in copper-lead-zinc rich soils. The far red and near-infrared MSS bands (MSS 3 and 4) and the near-infrared Thematic Mapper band (TM 4) were best in defining metal stress in vegetation, followed closely by the visible (TM 1, 2 and 3) and shortwave infrared (TM 5 and 7) Thematic Mapper bands. Both MSS- and TM-based transformations employing simple band ratios, normalized differences, and principal components generally produced poor to only fair results, with the exception of the first principal component. Author

A86-33629

EVALUATION OF LANDSAT MSS BANDS AND TRANSFORMATIONS FOR DETECTING HEAVY METAL STRESS IN FOREST-COVERED AREAS

C. BANNINGER (Graz, Technische Universitaet und Forschungszentrum; Institut fuer Digitale Bildverarbeitung und Graphik, Austria) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 957-963. refs

Single and transformed band Landsat MSS data from three scene dates of two tree stands growing in metal-rich soils show the first principal component and the Kauth-Thomas green vegetative and, to a lesser extent, the soil brightness indices to be overall best in discriminating heavy metal stress in vegetation. The next most useful, in decreasing order of importance, are Landsat bands 6 and 7, perpendicular vegetation indices, band differences, and simple band ratios (all employing Landsat bands 5, 6, and 7). Landsat bands 4 and 5 and the second principal component are the least useful for metal stress detection. Author

A86-33644* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

MULTI-CROP AREA ESTIMATION AND MAPPING ON A MICROPROCESSOR/MAINFRAME NETWORK

E. SHEFFNER (NASA, Ames Research Center; Technicolor Government Services, Inc., Moffett Field, CA) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 1117-1122.
(Contract NAS2-11101)

The data processing system is outlined for a 1985 test aimed at determining the performance characteristics of area estimation and mapping procedures connected with the California Cooperative Remote Sensing Project. The project is a joint effort of the USDA Statistical Reporting Service-Remote Sensing Branch, the California Department of Water Resources, NASA-Ames Research Center, and the University of California Remote Sensing Research Program. One objective of the program was to study performance when data processing is done on a microprocessor/mainframe network under operational conditions. The 1985 test covered the hardware, software, and network specifications and the integration of these three components. Plans for the year - including planned completion of PEDITOR software, testing of software on MIDAS, and accomplishment of data processing on the MIDAS-VAX-CRAY network - are discussed briefly. D.H.

A86-34740

REFLECTANCE MODELLING AND THE DERIVATION OF VEGETATION INDICES FOR AN AUSTRALIAN SEMI-ARID SHRUBLAND

R. P. PECH, R. D. GRAETZ (CSIRO, Div. of Wildlife and Rangelands Research, Lyneham, Australia), and A. W. DAVIS (CSIRO, Div. of Mathematics and Statistics, Glen Osmond, Australia) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, March 1986, p. 389-403. refs

Indices of vegetation 'cover' and 'greenness' are derived for Landsat MSS digital data for an Australian rangeland type, and their usefulness discussed with reference to the information content of the data and the effect of shadowing as an interaction between landscape components. The indices are related to a class of statistical models called mixture models which provides a formal framework for analyzing reflectance data from multicomponent surfaces. Author

A86-34741

FORESTRY INFORMATION CONTENT OF THEMATIC MAPPER DATA

D. N. H. HORLER (Horler Information, Inc., Ottawa, Canada) and F. J. AHERN (Canada Centre for Remote Sensing, Ottawa) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, March 1986, p. 405-428. refs

The spectral and radiometric properties of Thematic Mapper (TM) imagery are studied by principal component analysis. The principal components are: (1) brightness features, (2) greenness-type features, and (3) a contrast between visible and near-infrared regions and the shortwave infrared (SWIR) region. Landsat-4 data of the Dryden-Lac Seul region in western Ontario collected on September 26, 1982 is utilized in this study. The analysis reveals that the spectral data can be reduced to three eigenvectors with a loss of less than 10 percent of the scene variance. TM bands perform well for the three principal components; TM bands 3, 4, and 5 are applicable for general cover-type discrimination and bands 1, 4, and 5 for seperating a set of softwood classes. It is observed that the TM bands 5 and 7, which represent the SWIR spectral region, are sensitive to forest vegetation density. I.F.

A86-34742* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

IDENTIFYING DEFORESTATION IN BRAZIL USING MULTIRESOLUTION SATELLITE DATA

R. NELSON and B. HOLBEN (NASA, Goddard Space Flight Center, Greenbelt, MD) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, March 1986, p. 429-448. refs

The use of multiresolution satellite data to monitor deforestation on a continental/subcontinental scale is examined. MSS, local area coverage (LAC), global area coverage (GAC), and GOES data were applied to the study of deforestation in Rondonia, Brazil; the characteristics of these sensors are described. The probability thresholding and vegetation-index thresholding procedures used to process the data in order to differentiate between forest from nonforest are analyzed. The LAC, GAC, and GOES data are compared to MSS data. It is observed that GOES data is not useful for monitoring colonization projects due to excessive noise in the data; the GAC data is only applicable in large areas of contiguous forest clearing; the MSS data when available is applicable as a ground data reference source for differentiating cleared areas from primary; the LAC data are capable of delineating colonization clearings; and the probability thresholding procedure differentiates forest from nonforest more accurately than the vegetation-index procedure. The data reveal that the LAC data combined with the probability threshold procedure provide the best data-source/classification-procedure combination. I.F.

A86-34744

AN IMPROVED HYBRID CLASSIFIER

J. Y. KOO and M. KIM (Korea Advanced Institute of Science and Technology, Seoul, Republic of Korea) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, March 1986, p. 471-476.

A new hybrid classifier is proposed which utilizes the advantages of the maximum likelihood classifier and the parallelepiped classifier. The new hybrid classifier reduces the processing time more substantially than the conventional one by introducing a lower boundary for each class. The rate of misclassification is comparable to that of maximum likelihood classifier. Performance of the conventional and the new method are compared by an example. Author

A86-35677* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SPECTRAL CHARACTERIZATION OF BIOPHYSICAL CHARACTERISTICS IN A BOREAL FOREST - RELATIONSHIP BETWEEN THEMATIC MAPPER BAND REFLECTANCE AND LEAF AREA INDEX FOR ASPEN

G. D. BADHWAR, R. B. MACDONALD, F. G. HALL (NASA, Johnson Space Center, Houston, TX), and J. G. CARNES (Lockheed Engineering and Management Services Co., Houston, TX) (International Geoscience and Remote Sensing Symposium /IGARSS '84/: From Research toward Operational Use, Strasbourg, France, Aug. 27-30, 1984) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, May 1986, p. 322-326. Previously announced in STAR as N84-33875. refs

Results from analysis of a data set of simultaneous measurements of Thematic Mapper band reflectance and leaf area index are presented. The measurements were made over pure stands of Aspen in the Superior National Forest of northern Minnesota. The analysis indicates that the reflectance may be sensitive to the leaf area index of the Aspen early in the season. The sensitivity disappears as the season progresses. Based on the results of model calculations, an explanation for the observed relationship is developed. The model calculations indicate that the sensitivity of the reflectance to the Aspen overstory depends on the amount of understory present. ESA

A86-35678

A STABLE ITERATIVE PROCEDURE TO OBTAIN SOIL SURFACE PARAMETERS AND FLUXES FROM SATELLITE DATA

M. RAFFY and F. BECKER (Groupement Scientifique de Teledetection Spatiale, Strasbourg, France) (International Geoscience and Remote Sensing Symposium /IGARSS '84/: From Research toward Operational Use, Strasbourg, France, Aug. 27-30, 1984) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, May 1986, p. 327-333. CNRS-supported research. refs

Two general methods recently proposed to obtain the thermal inertia, the sensible heat flux, and the evapotranspiration flux from satellite data are summarized. In these methods, stable algorithms were used, but the stabilization coefficients exist and can lead to an iterative process to calculate the thermal inertia and the fluxes with improved accuracy despite errors of measurements. Some applications using in situ data and theoretically simulated data are given as an example. Author

A86-35679* Texas Univ., Arlington.

UTILIZATION OF ACTIVE MICROWAVE ROUGHNESS MEASUREMENTS TO IMPROVE PASSIVE MICROWAVE SOIL MOISTURE ESTIMATES OVER BARE SOILS

S. W. THEIS (Texas Instruments, Inc., McKinney), A. J. BLANCHARD (Texas, University, Arlington), and B. J. BLANCHARD (International Geoscience and Remote Sensing Symposium /IGARSS '84/: From Research toward Operational Use, Strasbourg, France, Aug. 27-30, 1984) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, May 1986, p. 334-339. USGS-USDA-supported research. Previously announced in STAR as N84-33896. refs
(Contract NSG-5134; DOC-MO-A01-78-004332)

Multisensor aircraft data were used to establish the potential of the active microwave sensor response to be used to compensate for roughness in the passive microwave sensor's response to soil moisture. Only bare fields were used. It is found that the L-band radiometer's capability to estimate soil moisture significantly improves when surface roughness is accounted for with the scatterometers. ESA

A86-35681

MICROWAVE EMISSION FROM ROW CROPS

D. R. BRUNFELDT (Applied Microwave Corp., Lawrence, KS) and F. T. ULABY (Michigan, University, Ann Arbor) (International Geoscience and Remote Sensing Symposium /IGARSS '84/: From Research toward Operational Use, Strasbourg, France, Aug. 27-30, 1984) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, May 1986, p. 353-359.

In order to examine the emission properties of vegetation without taking into consideration the effects of variations in the soil background, strips of metal screening were used to cover the soil surface between adjacent rows of plants. Temporal measurements were made at 2.7 and 5.1 GHz for soybean, wheat, and corn canopies. Several special experiments were conducted to evaluate the sensitivity of brightness temperature to look direction (relative to row direction), polarization configuration, and incidence angle, and to evaluate the emission contributions of defoliated stalks. In general, the results show that the canopy is highly anisotropic, the emission exhibits a strong dependence on polarization and look direction, and the scattering albedo is typically less than 0.1. Canopy transmissivity was estimated from the radiometric observations and then related empirically to the canopy's integrated water content. Using this relation in a zero-order radiative transfer model led to good agreement between the experimental observations and the model predictions. Author

A86-35687

SEGMENTATION OF A THEMATIC MAPPER IMAGE USING THE FUZZY C-MEANS CLUSTERING ALGORITHM

R. L. CANNON, J. C. BEZDEK (South Carolina, University, Columbia), J. V. DAVE (IBM Palo Alto Scientific Center, CA), and M. M. TRIVEDI (Louisiana State University, Baton Rouge) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, May 1986, p. 400-408. refs
(Contract NSF ECS-82-17191; NSF IST-84-07860)

In this paper, a segmentation procedure that utilizes a clustering algorithm based upon fuzzy set theory is developed. The procedure operates in a nonparametric unsupervised mode. The feasibility of the methodology is demonstrated by segmenting a six-band Landsat-4 digital image with 324 scan lines and 392 pixels per scan line. For this image, 100-percent ground cover information is available for estimating the quality of segmentation. About 80 percent of the imaged area contains corn and soybean fields near the peak of their growing season. The remaining 20 percent of the image contains 12 different types of ground cover classes that appear in regions of different sizes and shapes. The segmentation method uses the fuzzy c-means algorithm in two stages. The large number of clusters resulting from this segmentation process are then merged by use of a similarity measure on the cluster centers. Results are presented to show that this two-stage process leads to separation of corn and soybean, and of several minor classes that would otherwise be overwhelmed in any practical one-stage clustering. Author

A86-35748* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

POLARIZATION PHOTOMETER TO MEASURE BIDIRECTIONAL REFLECTANCE FACTOR R(55 DEG, 0 DEG, 55 DEG, 180 DEG) OF LEAVES

V. C. VANDERBILT (NASA, Ames Research Center, Moffett Field, CA; Purdue University, West Lafayette, IN) and L. GRANT (Purdue University, West Lafayette, IN) Optical Engineering (ISSN 0091-3286), vol. 25, April 1986, p. 566-571. refs
(Contract NAG5-269; NAS9-16528)

A polarization photometer has been developed for rapidly determining the bidirectional, polarized, and diffuse light-scattering properties of individual leaves illuminated and measured 'in vivo' at an angle of 55 deg (approximately Brewster's angle) in six wavelength bands in the visible and near-IR wavelength regions. The optical performance and data quality of the system are evaluated to estimate the magnitude of the variation in the data attributable to the instrument system and to measurement procedures. The potential to discriminate between three species of oak is demonstrated using data acquired by the polarization photometer. The instrument is being used to increase understanding of the radiation transfer process in plant canopies and specifically to determine how agronomic information of the physical and chemical processes in leaves, plants, and plant canopies is expressed in these light-scattering properties. Author

A86-36037#

FOREST SIGNATURES IN IMAGING AND NON-IMAGIHG MICROWAVE SCATTEROMETER DATA

A. J. SIEBER (DFVLR, Institut fuer Hochfrequenztechnik, Oberpfaffenhofen, West Germany) ESA Journal (ISSN 0379-2285), vol. 9, no. 4, 1985, p. 431-448. refs

X-band and L-band radars have been used to determine the signatures of both deciduous and coniferous trees. The information content of the radars is significantly influenced not only by the X- and L-band radar cross-sections of the trees, but also by the spatial resolutions of the measurements. It has been found that selection of the appropriate polarisation allows particular tree species to be identified. Author

A86-36042* National Aeronautics and Space Administration. Earth Resources Lab., Bay St. Louis, Miss.

ANALYSIS OF EFFECTIVE RADIANT TEMPERATURES IN A PACIFIC NORTHWEST FOREST USING THERMAL INFRARED MULTISPECTRAL SCANNER DATA

S. A. SADER (NASA, Earth Resources Laboratory, Bay St. Louis, MS) Remote Sensing of Environment (ISSN 0034-4257), vol. 19, April 1986, p. 105-115. refs

Analysis of Thermal Infrared Multispectral Scanner data collected over H. J. Andrews experimental forest in western Oregon indicated that aspect and slope gradient had a greater effect on the thermal emission of younger reforested clearcuts than of older stands. Older forest stands (older than 25 years) with greater amounts of green biomass and closed canopies, had lower effective radiant temperatures than younger, less dense stands. Aspect and slope had little effect on the effective radiant temperature of these older stands. Canopy temperature recorded at approximately 1:30 pm local time July 29, 1983 were nearly equal to maximum daily air temperature recorded at eight reference stands. The investigation provided some insights into the utility of the thermal sensor for detecting surface temperature differences related to forest composition and green biomass amounts in mountain terrain. Author

A86-36044

SOIL BACKGROUND EFFECTS ON THE SPECTRAL RESPONSE OF A THREE-COMPONENT RANGELAND SCENE

J. L. HEILMAN (Texas A & M University, College Station) and W. E. BOYD (Earth Observation Satellite Co., Lanham, MD) Remote Sensing of Environment (ISSN 0034-4257), vol. 19, April 1986, p. 127-137. refs

Landsat data were simulated for a grass, brush, and soil rangeland scene for active growth and summer dormancy, to evaluate the effect of soil background reflectance on the sensitivity ratio and orthogonal spectral indices to vegetation density. As the density of green vegetation increased, the sensitivities of the ratio vegetation index and the normalized difference decreased for low soil reflectance, and increased for high soil reflectance. Differences were found between some results obtained from published coefficients and those obtained from the simulated data. The results suggest that discrimination of brush and vegetation may not be possible during active growth (when the grass is dormant), and that even if soil-specific calibration and soil lines are used, the accuracy of vegetation density estimates derived from the indices may vary with soil background. R.R.

A86-36045* Illinois Univ., Chicago.
SCATTERING FROM A RANDOM LAYER EMBEDDED WITH DIELECTRIC NEEDLES
H. J. EOM (Illinois, University, Chicago) and A. K. FUNG (Texas, University, Arlington) Remote Sensing of Environment (ISSN 0034-4257), vol. 19, April 1986, p. 139-149. refs
(Contract NAG5-68; NAS9-15421)

Intensity scattering from a random layer imbedded with small dielectric needles is studied for applications to coniferous vegetation. The phase matrix of a thin needle whose length may be appreciable compared to the incident wavelength is presented. The effects of needle orientation on scattering is taken into account by averaging the phase function over angles of orientation. The backscattering coefficient from the layer is computed by solving the radiative transfer equation. The effects of operating frequency, orientation and size of a needle on like- and cross-backscattering are demonstrated. It was found that in backscattering angular trends are mainly controlled by the orientation of the needles. Author

A86-36046* Illinois Univ., Chicago.
REGRESSION MODELS FOR VEGETATION RADAR-BACKSCATTERING AND RADIOMETRIC EMISSION
H. J. EOM (Illinois, University, Chicago) Remote Sensing of Environment (ISSN 0034-4257), vol. 19, April 1986, p. 151-157. refs
(Contract NAG5-486)

Simple regression estimation of radar backscatter and radiometric emission from vegetative terrain is proposed, based on the exact radiative transfer models. A vegetative canopy is modeled as a Rayleigh scattering layer above an irregular Kirchhoff surface. The rms errors between the exact and the estimated ones are found to be less than 5 percent for emission, and 1 dB for the backscattering case, in most practical uses. The proposed formulas are useful in quickly estimating backscattering and emission from the vegetative terrain. Author

A86-36047* Kansas State Univ., Manhattan.
DISTINGUISHING AMONG TALLGRASS PRAIRIE COVER TYPES FROM MEASUREMENTS OF MULTISPECTRAL REFLECTANCE
G. ASRAR, R. L. WEISER, D. E. JOHNSON, E. T. KANEMASU, and J. M. KILLEEN (Kansas State University of Agriculture and Applied Science, Manhattan) Remote Sensing of Environment (ISSN 0034-4257), vol. 19, April 1986, p. 159-169. refs
(Contract NAS1-67457)

The heterogeneity in surface cover caused by management practices or natural events complicates monitoring the conditions of grasslands and assessing their productivity by remote sensing techniques. Statistical procedures were sought that would allow different grassland surface cover types (bare soil, senescent vegetation, and green vegetation) to be distinguished by using measurements of grassland multispectral reflectance. Two procedures, discriminant analysis and canonical discriminant analysis, were found suitable for achieving this objective. Linear classification functions and canonical variables were derived, which distinguish between the three cover types. A comparison between two sensor systems, a Barnes multiband radiometer and an Exotech radiometer that simulates the Landsat thematic mapper (TM) and multispectral scanner (MSS) bands, respectively, showed that the separability among the three cover types was substantially improved by the additional and improved spectral features of the Barnes radiometer. Author

A86-36049
EFFECT OF DEW ON CANOPY REFLECTANCE AND TEMPERATURE
P. J. PINTER, JR. (USDA, Water Conservation Laboratory, Phoenix, AZ) Remote Sensing of Environment (ISSN 0034-4257), vol. 19, April 1986, p. 187-205. refs

The diurnal behavior of canopy reflectance and emittance was characterized for six spring wheat cultivars using two ground-based radiometers that had spectral bandpass characteristics similar to the multispectral scanner and thematic mapper radiometers on Landsats 4 and 5. Nadir measurements of spectral reflectance and emittance were made over well-watered canopies with and without dew to determine its effect on each wavelength interval. The diurnal patterns of reflectances from canopies without dew were symmetric with respect to solar noon. However, when dew was present on canopies, morning reflectances in wavelengths shorter than 0.7 micron and longer than 1.15 microns were significantly different than those observed during the afternoon under similar solar zenith angles. Quantitative measurements of dew density in each cultivar established that moderately high dew levels increased reflectance in visible wavelengths by 40-60 percent and decreased reflectance in wavelengths between 1.15 and 2.35 microns by 25-60 percent. No effect of dew was noted in the near-IR region of the spectrum between 0.7 and 1.1 microns or the thermal IR 10.4-12.5 microns. Author

A86-36084
USE OF MULTITEMPORAL SPECTRAL PROFILES IN AGRICULTURAL LAND-COVER CLASSIFICATION
T. H. C. LO (Alabama, University, University), F. L. SCARPACE, and T. M. LILLESAND (Wisconsin, University, Madison) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, April 1986, p. 535-544. refs

A range of single date and multitemporal classification approaches was compared using Landsat MSS data acquired during the 1979 growing season in the vicinity of Green Bay, WI. In addition to evaluating the traditional supervised and unsupervised classification strategies typically applied in such efforts, an unsupervised multitemporal ratio approach was developed. This involved the use of multidate ratioed data in a clustering algorithm sensitive to image texture. A spectral variance threshold for a moving 3 by 3 pixel window in the image data was used to isolate homogeneous areas for cluster center definition. A temporal ratio profile for each cluster center was constructed and then labeled according to the local crop calendar. The paper highlights not only the ease of this procedure, but also its superior accuracy and consistency as compared to the traditional classification procedures tested. The practicality of such multitemporal analyses will be greatly enhanced by the 'on demand' image acquisition features of future satellite systems such as SPOT. Author

A86-36237
EVAPOTRANSPIRATION OVER AN AGRICULTURAL REGION USING A SURFACE FLUX/TEMPERATURE MODEL BASED ON NOAA-AVHRR DATA
O. TACONET, R. BERNARD, and D. VIDAL-MADJAR (Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Issy-les-Moulineaux, France) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 25, March 1986, p. 284-307. CNES-supported research. refs

A methodology was developed to infer daily evaporation and soil moisture distribution over large areas. It uses NOAA-7 surface data as input data in a one-dimensional boundary layer/vegetation/soil model based on the formation of Deardorff, which allows the use of a small number of mesoscale surface vegetation parameters. Model sensitivity tests indicate that a single surface temperature measured near midday is sufficient for obtaining the surface energy fluxes over dense vegetation, and for deriving the bulk canopy resistance to evaporation. The ability of the model to predict the area-averaged surface fluxes and canopy resistances over dense vegetation is examined in conjunction with experimental surface flux measurements for three cases over a flat monocultural region (the Beuce in France). Using an empirical expression which relates canopy resistance to root zone water content, an averaged evaluation of the soil moisture can be derived (assuming the absence of a current capability for routine daily soil-moisture observation over an agricultural region). Hence, the spatial gradient of water content between two distinct areas of Beuce is evaluated. K.K.

A86-36697

DETERMINATION OF THE SPECTRAL CHARACTERISTICS OF NATURAL OBJECTS ON TEST RANGES, AND ASPECTS OF THE EFFICIENCY OF SPACE SYSTEMS [OPREDELENIE SPEKTRAL'NYKH KHARAKTERISTIK PRIRODNYKH OB'EKTOV NA POLIGONAKH I VOPROSY EFFEKTIVNOSTI KOSMICHESKIKH SISTEM]

A. M. VOLKOV, ED. and S. G. IAKOVLEV, ED. Leningrad, Gidrometeoizdat (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov, Trudy, No. 24), 1985, 120 p. In Russian. No individual items are abstracted in this volume.

Papers are presented on various aspects of the remote sensing of earth resources. Particular attention is given to the measurement of the reflection characteristics of natural objects using airborne spectrometers; vegetation differentiation according to spectral characteristics; the cost effectiveness of satellite remote-sensing systems; the monitoring of the stability of instruments for measuring the brightness spectral density of natural objects; and the effect of the atmosphere on the spectral brightness of objects during remote sensing in the optical range. B.J.

A86-36783

SMALL FORMAT, OBLIQUE, COLOUR AERIAL PHOTOGRAPHY - AN AID TO THE LOCATION OF METHANE SEEPAGE

P. J. CURRAN (Sheffield, University, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, April 1986, p. 477-479. refs

A86-36789* Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

AN INFORMATION MEASURE FOR CLASS DISCRIMINATION

S. S. SHEN (Lockheed Engineering and Management Services Co., Inc., Houston, TX) and G. D. BADHWAR (NASA, Johnson Space Center, Houston, TX) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, April 1986, p. 547-556. refs

This article describes a separability measure for class discrimination. This measure is based on the Fisher information measure for estimating the mixing proportion of two classes. The Fisher information measure not only provides a means to assess quantitatively the information content in the features for separating classes, but also gives the lower bound for the variance of any unbiased estimate of the mixing proportion based on observations of the features. Unlike most commonly used separability measures, this measure is not dependent on the form of the probability distribution of the features and does not imply a specific estimation procedure. This is important because the probability distribution function that describes the data for a given class does not have simple analytic forms, such as a Gaussian. Results of applying this measure to compare the information content provided by three Landsat-derived feature vectors for the purpose of separating small grains from other crops are presented. Author

A86-37008* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

FIELD AND AIRBORNE SPECTRAL CHARACTERIZATION OF SUSPECTED DAMAGE IN RED SPRUCE (PICEA RUBENS) FROM VERMONT

B. N. ROCK, J. E. VOGELMANN (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), and D. L. WILLIAMS (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 71-81. NASA-supported research. refs

The utilization of remote sensing to monitor forest damage due to acid deposition is investigated. Spectral and water measurements and aircraft radiance data of red spruce and balsam fir, collected in Camels Hump Mountain and Ripton, Vermont between August 13-20, 1984, are analyzed to evaluate the damage levels of the trees. Variations in reflectance features and canopy moisture content are studied. It is observed that damage correlates with elevation (greater damage at higher elevations); xylem water column tension is greater at higher damage sites; and a 'blue shift' is indicated in the spectral data at high damage sites. I.F.

A86-37014

ADDING SPATIAL CONSIDERATIONS TO THE JABOWA MODEL OF FOREST GROWTH

D. B. BOTKIN, T. E. REYNALES, and K. D. WOODS (California, University, Santa Barbara) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 141-148. refs

Classical ecological questions about the nature of communities and spatial pattern in vegetation may be answered through the integration of data from remote sensing with ecosystem simulation models. JABOWA and related forest growth models have successfully simulated small plots but are not adequate for large-area projections. Study of vegetation pattern requires selection of an appropriate spatial resolution of 'grain size', which should be guided by the ecological phenomena studied and an understanding of the effects of adjacent units on one another. A forest sample plot size of 0.1 hectare is proposed as both ecologically appropriate and consistent with available resolution from remote sensing devices. The rationale and methodology for transforming JABOWA from a non-spatial 'gap' model to a model with the capacity to simulate the growth of spatially-related forest plots are discussed. Author

A86-37015

DETECTION OF BIOMASS BY AN EMPIRIC ALBEDO AND SPECTRAL REFLECTANCE MODEL IN THE SAHARA DESERT FROM LANDSAT-IMAGERY

M. C. MUEKSCH (Bonn, Universitaet, West Germany) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 149-156. refs

A86-37016* Wisconsin Univ., Madison.

MODELING THE CONTROLS OF FOREST PRODUCTIVITY USING CANOPY VARIABLES

J. D. ABER and J. FOWNES (Wisconsin, University, Madison) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 157-161. Research supported by the University of Wisconsin. refs
(Contract NCA2-IR-865-401)

A framework is presented by which a generalized, canopy-driven model of biogeochemical cycling in forest ecosystems may be produced. Recent research results demonstrating relationships between canopy characteristics and important ecosystem processes are used to support this approach. Most relationships hold across species groups and suggest that identification of species may not be crucial. Linking this type of model to remote sensing will depend on developing the capability to measure a few key morphological and chemical parameters of whole forest canopies by reflectance characteristics. Author

A86-37018* National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.

ANALYSIS OF DATA ACQUIRED BY SHUTTLE IMAGING RADAR SIR-A AND LANDSAT THEMATIC MAPPER OVER BALDWIN COUNTY, ALABAMA

S.-T. WU (NASA, National Space Technology Laboratories, Bay Saint Louis, MS) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 173-182. refs

Seasonally compatible data collected by SIR-A and by Landsat 4 TM over the lower coastal plain in Alabama were coregistered, forming a SIR-A/TM multichannel data set with 30 m x 30 m pixel size. Spectral signature plots and histogram analysis of the data were used to observe data characteristics. Radar returns from pine forest classes correlated highly with the tree ages, suggesting the potential utility of microwave remote sensing for forest biomass estimation. As compared with the TM-only data set, the use of SIR-A/TM data set improved classification accuracy of the seven land cover types studied. In addition, the SIR-A/TM classified data support ,previous finding by Engheta and Elachi (1982) that microwave data appear to be correlated with differing bottomland hardwood forest vegetation as associated with varying water regimens (i.e., wet versus dry). I.S.

A86-37020

INTEGRATION OF HIGH AND LOW RESOLUTION SATELLITE DATA FOR CROP CONDITION ASSESSMENT

R. J. BROWN and C. PREVOST (Canada Centre for Remote Sensing, Ottawa) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 189-196. refs

Landsat multispectral scanner (MSS) and NOAA Advanced Very High Resolution Radiometer (AVHRR) imagery were registered and the radiances from several sites were measured. The Landsat data were used to assess which ground cover types were contributing to the AVHRR radiance values and to evaluate the effect nongrain classes would have on estimating grain crop condition. It is seen that great care must be taken in directly comparing areas within one data source with different crop mixes and vegetation classes since the total contribution of the grains to the vegetation index, as measured by the AVHRR, can be less than 40 percent. However, reliable use can be made of the AVHRR data if a comparison is made from year to year for a particular region. Author

A86-37025

SEMI-OPERATIONAL IDENTIFICATION OF AGRICULTURAL CROPS FROM AIRBORNE SLAR-DATA

P. BINNENKADE (Nationaal Lucht- en Ruimtevaartlaboratorium, Amsterdam, Netherlands), H. W. J. VAN KASTEREN, and D. UENK (Centrum voor Agrobiologisch Onderzoek, Wageningen, Netherlands) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 241-247. refs

The 1984-airborne SLAR campaign of the Dutch ROVE-team is discussed. Through preprocessing, segmentation, and pseudohierarchical classification a multitemporal data set of three test sites is treated for identification of potatoes and other agricultural crops. Author

A86-37034* National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.

AGRICULTURAL APPLICATIONS FOR THERMAL INFRARED MULTISPECTRAL SCANNER DATA

R. E. PELLETIER, M. C. OCHOA (NASA, National Space Technology Laboratories, Bay Saint Louis, MS), and B. F. HAJEK (Auburn University, AL) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 321-328. refs

The use of the Thermal Infrared Multispectral Scanner (TIMS) data in agricultural landscapes is discussed. The TIMS allows for narrow-band analysis in the 8.2-11.6 micron range at spatial resolutions down to 5 meters in cell size. A coastal plain region in SE Alabama was studied using the TIMS. The crop/plant vigor, canopy density, and thermal response changes for soils obtained from thermal imagery are examined. The application of TIMS data to hydrologic and topographic issues, inventory and conservation monitoring, and the enhancement and extraction of cartographic features is described. I.F.

A86-37035

THE TASSELED CAP - SIZE, SHAPE AND ORIENTATION CHANGES DUE TO SOIL BACKGROUND

A. R. HUETE (Arizona, University, Tucson) and R. D. JACKSON (USDA, Water Conservation Laboratory, Phoenix, AZ) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 329-337. refs

The empirical domain of the Tasseled Cap Graphic Model was examined in the soil brightness-plant greenness plane. Individual, soil-specific tasseled caps were derived for four different soil types with similar plant canopy conditions in order to analyze soil background influences on greenness results. The size, shape and orientation of these tasseled caps were strongly dependent on soil type, and greenness results for identical plant canopy conditions were not reproducible across tasseled caps. Greenness was comparable only when individual tasseled caps were scaled to similar sizes. In contrast to the global tasseled cap, soil-specific models significantly improved vegetation assessment, particularly at low green canopy covers. Author

A86-37036

WAVELENGTH INTENSITY INDICES IN RELATION TO TREE CONDITION AND LEAF-NUTRIENT CONTENT

S.-F. SHIH, D. L. MYHRE, G. J. EDWARDS, C. H. BLAZQUEZ, and J. M. GARDNER (Florida, University, Gainesville) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 350-356. refs

As an alternative to assessing occurrence of citrus blight with conventional techniques, wavelength intensity indices were used to estimate tree health status and the leaf contents of Zn, Na, K, Mg, Ca, P, Cu, and Al. The results of chemical analysis showed that the leaves of declined trees have a tendency to be low in K and Mg and high in Na, Ca, and Al. Photographs made with infrared film were analyzed by densitometry. On the basis of statistical analysis, the parameters of wavelength intensity indices correlating most strongly with either the leaf nutrient content or the tree health status were selected. I.S.

A86-39002* Purdue Univ., West Lafayette, Ind.

SUN ANGLE, VIEW ANGLE, AND BACKGROUND EFFECTS ON SPECTRAL RESPONSE OF SIMULATED BALSAM FIR CANOPIES

K. J. RANSON, C. S. T. DAUGHTRY, and L. L. BIEHL (Purdue University, West Lafayette, IN) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, May 1986, p. 649-658. refs
(Contract NAS9-16528)

An experiment is described that examines the effects of solar zenith angle and background reflectance on the composite scene reflectance of small balsam fir (Abies balsamea (L.) Mill.) arranged in different densities. In this study, the shape, density, and, consequently, the needle area index and phytomass of the canopies, as well as the background reflectance, were controlled. The effects of sun angle, view angle, and background reflectance on the multispectral response of small balsam fir trees were significant. Regression models relating spectral vegetation indices (i.e., normalized difference (ND) and greenness (GR) to phytomass) showed very poor relationships for balsam fir canopies with a grass background. However, strong linear relationships were found for ND and GR with phytomass for a background that simulated the reflectance of snow. Changing solar zenith angle significantly affected the models relating ND to phytomass for the snow background, but was not significant in the model relating GR to phytomass for the snow background Author

A86-39003* Washington Univ., St. Louis, Mo.

USE OF SIR-A AND LANDSAT MSS DATA IN MAPPING SHRUB AND INTERSHRUB VEGETATION AT KOONAMORE, SOUTH AUSTRALIA

G. M. GREEN (Washington University, St. Louis, MO) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, May 1986, p. 659-670. refs
(Contract JPL-956427; JPL-956515)

Shrublands cover much of the interior of the Australian continent and support a large grazing industry. Distinguishing the woody perennial vegetation from the smaller herbaceous vegetation and soil-encrusting lichen found between the shrubs is critical for range management but is difficult to do using Landsat data alone. In this study Shuttle Imaging Radar-A (SIR-A) and Landsat data acquired over Koonamore Station are examined together. Given the low topography and fine textured soils at Koonamore, radar return should be primarily determined by the percent area occupied by shrubs. During periods when most of the vegetation was non-vigorous and spectrally homogeneous, SIR-A data, as a surrogate measure of shrub cover, allowed the reflectance due to shrubs in Landsat data to be separated from the reflectance due to the intervening ground. This method allows estimation of the intershrub reflectance properties that are related to herbaceous vegetation, lichen, and bare soil exposures. Author

A86-39006

PREDICTING TREE GROUNDLINE DIAMETER FROM CROWN MEASUREMENTS MADE ON 35-MM AERIAL PHOTOGRAPHY

G. F. HAGAN (Purdue University, West Lafayette, IN) and J. L. SMITH (Virginia Polytechnic Institute and State University, Blacksburg) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, May 1986, p. 687-690. refs

A86-39146* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DIRECTIONAL REFLECTANCE RESPONSE IN AVHRR RED AND NEAR-IR BANDS FOR THREE COVER TYPES AND VARYING ATMOSPHERIC CONDITIONS

B. HOLBEN, D. KIMES, and R. S. FRASER (NASA, Goddard Space Flight Center, Greenbelt, MD) Remote Sensing of Environment (ISSN 0034-4257), vol. 19, June 1986, p. 213-236. refs

Surface directional red and near-infrared reflectances of bare soil, orchard grass, and fescue were extracted from a multitemporal data set to correspond to NOAA-7 Advanced Very High Resolution Radiometer (AVHRR) scanning and illumination geometry at 30 deg latitude. Radiances were simulated at satellite altitude and a ratio vegetation index was calculated. The results show that off-nadir directional reflectance measured at the surface in the red and near-IR portions of the spectrum are approximately maintained with AVHRR viewing and illumination characteristics. The two-channel reflectance response is such that the ratio vegetation index is more constant with scan angle and atmospheric conditions than individual channels. It is shown that inclusion of atmospheric and surface reflectance data can greatly improve interpretation of AVHRR data, when knowledge of the range of atmospheric conditions and approximate directional reflectances of major cover types are known. Author

A86-39147

SEPARATION OF SOIL-PLANT SPECTRAL MIXTURES BY FACTOR ANALYSIS

A. R. HUETE (Arizona, University, Tucson) Remote Sensing of Environment (ISSN 0034-4257), vol. 19, June 1986, p. 237-251. refs

A factor-analytic inversion model is presented which enables a data set of spectral mixtures to be decomposed into the sum of unique reflecting components weighted by their corresponding amounts. Spectral mixtures are decomposed into abstract eigenspectra and eigenvector matrices. The eigenspectra are then transformed into pure component spectral signature through a target testing procedure that allows one to individually search for the presence of ground reflecting features. Soil-plant mixtures with variable soil moisture and plant densities were successfully decomposed into dry soil, wet soil, and vegetation components and their respective amounts in all spectral mixtures were determined. Potential uses of factor analysis in soil identification and biomass assessment are discussed. Author

A86-39148* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ANALYSIS OF A RESISTANCE-ENERGY BALANCE METHOD FOR ESTIMATING DAILY EVAPORATION FROM WHEAT PLOTS USING ONE-TIME-OF-DAY INFRARED TEMPERATURE OBSERVATIONS

B. J. CHOUDHURY (NASA, Goddard Space Flight Center, Greenbelt, MD), S. B. IDSO, and R. J. REGINATO (USDA, Water Conservation Laboratory, Phoenix, AZ) Remote Sensing of Environment (ISSN 0034-4257), vol. 19, June 1986, p. 253-268. refs

Accurate estimates of evaporation over field-scale or larger areas are needed in hydrologic studies, irrigation scheduling, and meteorology. Remotely sensed surface temperature might be used in a model to calculate evaporation. A resistance-energy balance model, which combines an energy balance equation, the Penman-Monteith (1981) evaporation equation, and van den Honert's (1948) equation for water extraction by plant roots, is analyzed for estimating daily evaporation from wheat using postnoon canopy temperature measurements. Additional data requirements are half-hourly averages of solar radiation, air and dew point temperatures, and wind speed, along with reasonable estimates of canopy emissivity, albedo, height, and leaf area index. Evaporation fluxes were measured in the field by precision weighing lysimeters for well-watered and water-stressed wheat. Errors in computed daily evaporation were generally less than 10 percent, while errors in cumulative evaporation for 10 clear sky days were less than 5 percent for both well-watered and water-stressed wheat. Some results from sensitivity analysis of the model are also given. Author

A86-39149* Kansas Univ. Center for Research, Inc., Lawrence.

IDENTIFICATION OF MAJOR BACKSCATTERING SOURCES IN TREES AND SHRUBS AT 10 GHZ

R. ZOUGHI, L. K. WU, and R. K. MOORE (University of Kansas Center for Research, Inc., Lawrence) Remote Sensing of Environment (ISSN 0034-4257), vol. 19, June 1986, p. 269-290. refs
(Contract NAG5-271)

A short-range very-fine-resolution FM-CW radar scatterometer has been used to identify the primary contributors to 10-GHz radar backscatter from pine, pin oak, American sycamore and sugar maple trees, and from creeping juniper shrubs. This system provided a range resolution of 11 cm and gave a 16-cm diameter illumination area at the target range of about 4 m. For a pine tree, the needles caused the strongest backscatter as well as the strongest attenuation in the radar signal. Cones, although insignificant contributors to the total backscatter, were more important for backscattering than for attenuation. For the rest of the trees, leaves were the strongest cause of backscattering and attenuation. However, in the absence of leaves, the petioles, small twigs, and branches gave relatively strong backscatter. For American sycamore and sugar maple trees, the fruits did not affect the total backscatter unless they were packed in clusters. For creeping juniper the backscattered energy and attenuation in the radar signal were mainly due to the top two layers of the evergreen scales. The contribution of the tree trunks was not determined. Author

N86-23994*# Delaware Univ., Newark. Coll. of Marine Studies.
REMOTE SENSING INVESTIGATIONS OF WETLAND BIOMASS AND PRODUCTIVITY FOR GLOBAL BIOSYSTEMS RESEARCH Final Technical Report, 1 Nov. 1982 - 1 Apr. 1986
V. KLEMAS 15 Apr. 1986 25 p refs
(Contract NAGW-374)
(NASA-CR-176725; NAS 1.26:176725) Avail: NTIS HC A02/MF A01 CSCL 08B

The relationship between spectral radiance and plant canopy biomass was studied in wetlands. Spectroradiometer data was gathered on Thematic Mapper wavebands 3, 4, and 5, and correlated with canopy and edaphic factors determined by harvesting. The relationship between spectral radiance and plant canopy biomass for major salt and brackish canopy types was determined. Algorithms were developed for biomass measurement in mangrove swamps. The influence of latitudinal variability in canopy structure on biomass assessment of selected plants was investigated. Brackish marsh biomass estimates were obtained from low altitude aircraft and compared with ground measurements. Annual net aerial primary productivity estimates computed from spectral radiance data were compiled for a Spartina alterniflora marsh. Spectral radiance data were expressed as vegetation or infrared index values. Biomass estimates computed from models were in close agreement with biomass estimates determined from harvests. Author

N86-23995*# Operations Research, Inc., Landover, Md.
EOS RADIOMETER CONCEPTS FOR SOIL MOISTURE REMOTE SENSING Final Report
J. CARR 10 Feb. 1986 175 p
(Contract NAS5-28648)
(NASA-CR-177854; NAS 1.26:177854) Avail: NTIS HC A08/MF A01 CSCL 08B

Preliminary work with aperture synthesis concepts for EOS is reported. The effects of nonvanishing bandwidths on image reconstruction in aperture synthesis system was studied. It is found that nonvanishing bandwidths introduce errors in off-axis pixels when naive Fourier processing is used. The net effect is for bandwidth to limit sensor field-of-view. To quantify this effect a computer program was written which is documented. Example runs are included which illustrate the resultant radiometric errors and effective fields-of-view for a plausible simple sensor. Author

N86-25032# National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
DUCKS UNLIMITED JOINT RESEARCH PROJECT Final Report
C. L. HILL Dec. 1985 175 p refs
(NASA-TM-88755; NAS 1.15:88755; ERL-238) Avail: NTIS HC A08/MF A01 CSCL 13B

The feasibility of using LANDSAT thematic mapper (TM) data and geographic information system technology as part of a waterfowl habitat inventory and assessment program was determined. The TM data analysis offers interesting results in wetland mapping. The best technique is the one that utilizes a distance derived mask as input to a modified orthogonal parallelepiped classifier. The classification technique (CLPIPE) and the statistical software module (FIND) are incorporated into a production software runstream (DUCK.CAN). The production runstream allows analysis with geographically referenced raw data, to complete the classification process, develop statistical reports, and produce final output products in the form of maps and tables. It is concluded that the TM has the capability to spectrally identify wetland categories. E.A.K.

N86-25034*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CONCEPTUAL DESIGN STUDY: FOREST FIRE ADVANCED SYSTEM TECHNOLOGY (FFAST)
J. D. NICHOLS and J. R. WARREN (Department of Agriculture, Washington, D.C.) 15 Feb. 1986 132 p refs
(Contract NAS7-918)
(JPL-PUBL-86-5; NAS 1.26:177214; NASA-CR-177214) Avail: NTIS HC A07/MF A01 CSCL 02F

An integrated forest fire detection and mapping system that will be based upon technology available in the 1990s was defined. Uncertainties in emerging and advanced technologies related to the conceptual design were identified and recommended for inclusion as preferred system components. System component technologies identified for an end-to-end system include thermal infrared, linear array detectors, automatic georeferencing and signal processing, geosynchronous satellite communication links, and advanced data integration and display. Potential system configuration options were developed and examined for possible inclusion in the preferred system configuration. The preferred system configuration will provide increased performance and be cost effective over the system currently in use. Forest fire management user requirements and the system component emerging technologies were the basis for the system configuration design. A preferred system configuration was defined that warrants continued refinement and development, examined economic aspects of the current and preferred system, and provided preliminary cost estimates for follow-on system prototype development. B.G.

N86-25863*# National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
TIMBER RESOURCES INVENTORY AND MONITORING JOINT RESEARCH PROJECT
C. L. HILL Oct. 1985 35 p refs Prepared in cooperation with International Paper Co., Tuxedo Park, N.Y. Original contains color illustrations
(NASA-TM-88754; NAS 1.15:88754; ERL-237) Avail: NTIS HC A03/MF A01 CSCL 02F

Primary objectives were to develop remote sensing analysis techniques for extracting forest related information from LANDSAT Multispectral Scanner (MMS) and Thematic Mapper data and to determine the extent to which International Paper Company information needs can be addressed with remote sensing information. The company actively manages 8.4 million acres of forest land. Traditionally, their forest inventories, updated on a three year cycle, are conducted through field surveys and aerial photography. The results reside in a digital forest data base containing 240 descriptive parameteres for individual forest stands. The information in the data base is used to develop seasonal and long range management strategies. Forest stand condition assessements (species composition, age, and density stratification) and identification of silvicultural activities (site preparation, planting, thinning, and harvest) are addressed. B.G.

N86-26666# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

A PROPOSAL FOR A PROJECT ENTITLED ASSESSMENT OF FOREST RESOURCES IN URUGUAY SUBMITTED TO THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION (UNIDO)

R. A. NOVAES, D. C. L. LEE, P. H. FILHO, A. PACHECODOSSANTOS, and F. J. PONZONI Mar. 1986 13 p
(INPE-3828-NTE/255) Avail: NTIS HC A02/MF A01

This project proposal was submitted by request of the United Nations Industrial Development Organization (UNIDO). The main objective is to collect basis forest information for the development, promotion, and utilization of alternative sources of energy through the use of Uruguay's national resources and to define the value of LANDSAT-TM as an aid in efficient management of the country's plantations. An additional objective is to train the Uruguayan technical team. Indications are given as to how each task will be accomplished and what techniques will be employed in performing main tasks such as: forest mapping and development of map legends, map accuracy assessment and forest area correction, stand timber volume evaluation, field sampling, and mensuration procedures. Flow diagrams of the overall project, activity bar diagrams, and list of equipment required for task completion are included. The expected results of the map products and timber volumes are discussed. Author

N86-26667# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

WHEAT AREA ESTIMATION USING DIGITAL LANDSAT MSS DATA AND AERIAL PHOTOGRAPHS

M. A. MOREIRA, S. C. CHEN, and G. T. BATISTA Mar. 1986 28 p Submitted for publication
(INPE-3824-PRE/900) Avail: NTIS HC A03/MF A01

A procedure to estimate wheat (Triticum aestivum L) area using sampling technique based on aerial photographs and digital LANDSAT MSS data was developed. Aerial photographs covering 720 sq km were visually analyzed. Computer classification of LANDSAT MSS data acquired on Sept. 4, 1979 was done using unsupervised and supervised algorithms and classification results were spatially filtered using a post-processing technique. To estimate wheat area, a regression approach was applied using different sample sizes and various sampling units. Based on four decision criteria proposed in this study, it was concluded that: (1) as the size of sampling unit decreased, the percentage of sample area required to obtain similar estimation performance also decreased; (2) the lowest percentage of the area sampled for wheat estimation under established precision and accuracy criteria through regression estimation was 13.09% using 10 sq km as the sampling unit; and (3) wheat area estimation obtained by regression estimation was more precise and accurate than those obtained by direct expansion method. Author

N86-26674# Institute for Land and Water Management Research, Wageningen (Netherlands). Subfaculteit Wiskunde en Informatica.

A MULTIINDEX MULTITEMPORAL APPROACH TO MAP CROPS IN THE EARLY GROWING SEASON: AN APPLICATION TO TWO ITALIAN IRRIGATION DISTRICTS: EAST SESIA AND GRANDE BONIFICA FERRARESE

M. S. DOTT and S. AZZALI May 1985 42 p Sponsored by European Economic Commission
(ICW-1611; ESA-86-96955) Avail: NTIS HC A03/MF A01

The feasibility of a method to determine quality, quantity, and type of crops and their water stress by LANDSAT images was tested in two irrigation districts in the Po valley, Italy. In spite of striking misestimates, results are promising, 5 out of 11 crops being detected. However, the uncertain number of yearly available images and lack of reference data to tune the method inhibit the operational development of this tool. It is emphasized that the feasibility of mapping individual crops by means of LANDSAT-MSS data is definitely proven in principle. A semioperational use of such data would provide an opportunity to iron out practical details and assess the amount of needed ancillary and ground-reference data, given the required accuracy of determination. ESA

N86-27696*# Maryland Univ., College Park. Office of Sponsored Programs.

DEPARTMENT OF GEOLOGY/NASA-GSFC GEOBOTANICAL INVESTIGATION Summary Report

26 May 1986 10 p refs
(Contract NSG-5423)
(NASA-CR-177300; NAS 1.26:177300) Avail: NTIS HC A02/MF A01 CSCL 02F

Geobotanical mapping in the southern Appalachians and soil metal associated changes in vegatation spectral responses in the reflective and emissive portions of the electromagnetic spectrum (EMS) is studied. It is determined whether deciduous forest vegetation reflection and emission characteristics show detectable changes that can be related to residual soil characteristics. Analyses of such related characteristics enhances the ability to discriminate underlying lithologies as well as variances within lithologies associated with natural heavy metal occurences. An understanding is developed of the factors which contribute to the differing spectral signatures of various lithology/soil types. A combination of field data and remote spectral analysis is studied. E.R.

N86-27704*# Pennsylvania State Univ., University Park. Dept. of Meteorology.

PRELIMINARY ASSESSMENT OF SOIL MOISTURE OVER VEGETATION Final Report, 1 Mar. 1985 - 28 Feb. 1986

T. N. CARLSON Jul. 1986 40 p
(Contract NAG5-184)
(NASA-CR-177226; NAS 1.26:177226) Avail: NTIS HC A03/MF A01 CSCL 08M

Modeling of surface energy fluxes was combined with in-situ measurement of surface parameters, specifically the surface sensible heat flux and the substrate soil moisture. A vegetation component was incorporated in the atmospheric/substrate model and subsequently showed that fluxes over vegetation can be very much different than those over bare soil for a given surface-air temperature difference. The temperature signatures measured by a satellite or airborne radiometer should be interpreted in conjunction with surface measurements of modeled parameters. Paradoxically, analyses of the large-scale distribution of soil moisture availability shows that there is a very high correlation between antecedent precipitation and inferred surface moisture availability, even when no specific vegetation parameterization is used in the boundary layer model. Preparatory work was begun in streamlining the present boundary layer model, developing better algorithms for relating surface temperatures to substrate moisture, preparing for participation in the French HAPEX experiment, and analyzing aircraft microwave and radiometric surface temperature data for the 1983 French Beauce experiments. B.G.

02

ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

Includes land use analysis, urban and metropilitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.

A86-30195

REMOTE SENSING FOR DEVELOPING COUNTRIES - A CASE STUDY OF TUNISIA

A. HAMZA (Ministry of Agriculture, Soils Directorate, Tunis, Tunisia) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Feb. 1986, p. 283-286.

The use of satellite remote sensing for the technological and economic advancement of developing countries is examined. The development of a country is achieved by quantitative and qualitative knowledge of resources, exploitation and management of these resources, and control of the resources. Remote sensing data are studied in order to evaluate and control the resources of developing nations. The national and international remote sensing strategies and infrastructures required for developiong countries to successfully employ remote sensing technology are described. Examples of remote-sensing application studies in Tunisia are given. I.F.

A86-30974

POSSIBILITY OF SMALL-SCALE PHYSICOGEOGRAPHICAL REGIONALIZATION USING SPACE SPECTROMETRY DATA [O VOZMOZHNOSTI MELKOMASSHTABNOGO FIZIKO-GEOGRAFICHESKOGO RAIONIROVANIIA PO DANNYM KOSMICHESKOGO SPEKTROMETRIROVANIIA]

L. I. KISELEVSKII, B. I. BELIAEV, V. E. PLIUTA, and S. G. SINIAKOVICH (AN BSSR, Institut Fiziki, Minsk, Belorussian SSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 286, no. 5, 1986, p. 1236-1240. In Russian.

Small scale physicogeographical regionalization has been demonstrated using Salyut-4 spectrometry data in the 0.4-0.8 micron range. The study involved boundary definition according to optical-field differences in the case of gradual transitions between physicogeographic zones. The data analyzed covered forest, forest-steppe, steppe, semiarid, and mountainous areas. B.J.

A86-32537

DETECTING DESERT LOCUST BREEDING GROUNDS IN THE SAHEL WITH SATELLITE DATA

P. V. RIGTERINK (Computer Sciences Corp., Silver Spring, MD) IN: EASCON '85: National space strategy - A progress report; Proceedings of the Eighteenth Annual Electronics and Aerospace Systems Conference, Washington, DC, October 28-30, 1985 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 141-143. refs

The problem of detecting desert locust breeding grounds in the Sahel region of Africa with satellite data is reviewed. Early information demonstrated the feasibility of a variety of techniques which were only marginally cost-effective. Recently, a number of scientists have realized that the AVHRR sensor on the NOAA series of satellites will provide appropriate data at a reasonable price. This paper will describe various techniques for processing these data and recommend an approach ior future data processing. Author

A86-33595

APPROACHES TO COMPUTER REASONING IN REMOTE SENSING AND GEOGRAPHIC INFORMATION PROCESSING - A SURVEY

P. H. SWAIN (Purdue University, West Lafayette, IN) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 687-692. refs

(Contract NSF ECS-84-00324)

A survey is given of a number of approaches to computerized reasoning which have been or might be applied to multi-attribute geographic data. Possible low level reasoning methods include: the stacked vector approach, source-specific prior probabilities and a generalization of that approach by Swain et al. (1985), and a contextual classification method. An expert system for change detection represents a possible implementation of higher level reasoning. Possible future directions that such research might take are indicated. D.H.

A86-33643

RESOURCE MONITORING ORIENTED REMOTE SENSING DATA PROCESSING CAPABILITIES

K. STAENZ, E. H. MEIER, D. R. NUESCH, K. I. ITTEN, and H. HAEFNER (Zuerich, Universitaet, Zurich, Switzerland) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 1109-1116. refs

Digital image processing capabilities of the University of Zurich are demonstrated with particular emphasis on two image analysis systems, called IBIS and DIPS. In addition, an overview is given over the most important projects (research, development, and applications) conducted in the past as well as currently under way. Further needs in connection with the resource monitoring tasks are discussed. Author

A86-36513

THE POSSIBILITY OF APPLYING DIFFERENT TYPES OF IMAGE-ANALYSIS SOFTWARE TO ENVIRONMENT-PROTECTION PROBLEMS [VOZMOZHNOSTI PRIMENENIIA RAZNORODNOGO PROGRAMMNOGO OBESPECHENIIA ANALIZA IZOBRAZHENII DLIA ZADACH OKHRANY OKRUZHAIUSHCHEI SREDY]

A. D. KITOV IN: Methods of combined air and space remote-sensing studies of Siberia . Novosibirsk, Izdatel'stvo Nauka, 1985, p. 63-69. In Russian. refs

Software-requirements for an environment-protection approach that employs remote monitoring are formulated for the specific example of pollutant emissions from power plants. Information on existing image-processing software is presented, and the applicability of this software to environment protection is discussed. B.J.

A86-37011

A MEASURING REFERENCE SYSTEM TO QUANTIFY THE DESERTIFICATION PROCESS IN A SEMIARID ECOSYSTEM BASED ON LANDSAT MSS DATA

J. C. DE LA TORRE, J. H. SASSER, and J. LIRA (Direccion General de Geografia, Mexico City, Mexico) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 112-121. refs

Landsat MSS data of a 3600 sq km test site in Mexico, collected over a 9 years period, are used to evaluate the state and rate of change of desertification. A desertification model is derived from the mean albedo and mean information content of the target system. The applicability of the model is verified in three experiments. The first experiment simulated the process of desertification by analyzing a 64 x 64 pixel window, the second utilized a set of 64 x 64 pixel windows, and the third experiment tested the capability of the model to measure the state and progression of desertification. It is observed that albedo and information content are important indicators of desertification. I.F.

A86-38677

ENVIRONMENT AND CLIMATE [OKRUZHAIUSHCHAIA SREDA I KLIMAT]

K. IA. KONDRATEV Leningrad, Obshchestvo Znanie RSFSR, 1985, 32 p. In Russian. refs

The book is concerned with the effect of the pollution of the atmosphere, water basins, and soil on global climate. It is shown that the most significant changes in climate are associated with an increase in the concentration of carbon dioxide and other optically active small gas components. The increasing carbon dioxide concentration contributes to the greenhouse effect, leading to a general warming of the climate. The discussion also covers space-based observations of environmental changes, global ecological monitoring, and the climate of planets. V.L.

N86-24034# Army Cold Regions Test Center, APO Seattle, Wash. 98733.
VEGETATION AND ENVIRONMENTAL GRADIENTS OF THE PRUDHOE BAY REGION, ALASKA
D. A. WALKER Sep. 1985 238 p
(AD-A162022; CRREL-85-14) Avail: NTIS HC A11/MF A01 CSCL 06C

The following topics are discussed: description of the region (topography, geology, climate, soils, wildlife, oil-field facilities, environmental impacts); microscale gradients; plant communities along the major microscale gradients, aerial analysis of vegetation and other geobotanical units, influence of microscale patterns on soil factors and individual plant taxa; mesoscale gradients; macroscale gradients; floristic analysis; growth of salix lanata along the summer temperature gradient; annotated plant checklist for the Prudhoe Bay region; environmental and species data for the permanent study plots; environmental and vegetation data summaries for all stand types; supplementary floristic data. GRA

N86-25036# EG and G Energy Measurements, Inc., Las Vegas, Nev.
COMPREHENSIVE INTEGRATED REMOTE SENSING FOR US DEPARTMENT OF ENERGY APPLICATIONS
L. R. TINNEY and J. G. LACKEY 1985 10 p refs Presented at the International Conference on Man's Role in Changing the Global Environment, Venice, Italy, 21 Oct. 1985
(Contract DE-AC08-83NV-10282)
(DE86-002101; EGG-10282-1098; CONF-8510222-1) Avail: NTIS HC A02/MF A01

A major remote sensing program of the Department of Energy (DOE) is described and examples of processed data are presented. The program is termed Comprehensive Integrated Remote Sensing, or CIRS, and involves equipment and personnel of the DOE Remote Sensing Laboratory. Data is being collected to support environmental and emergency response functions for large DOE sites. Integration of the data is being enhanced by implementation of a geographic information system. DOE

N86-26669*# Kansas Univ. Center for Research, Inc., Lawrence. Space Technology Center.
RESEARCH ON ENHANCING THE UTILIZATION OF DIGITAL MULTISPECTRAL DATA AND GEOGRAPHIC INFORMATION SYSTEMS IN GLOBAL HABITABILITY STUDIES Final Report, 1985-1986
E. A. MARTINKO and J. W. MERCHANT Feb. 1986 60 p Sponsored in part by the Kansas Fish and Game Commission
(Contract NGL-17-004-024)
(NASA-CR-177294; NAS 1.26:177294) Avail: NTIS HC A04/MF A01 CSCL 05B

The University of Kansas Applied Remote Sensing (KARS) program is engaged in a continuing long term research and development effort designed to reveal and facilitate new applications of remote sensing technology for decision makers in governmental agencies and private firms. Some objectives of the program follows. The development of new modes of analyzing multispectral scanner, aerial camera, thermal scanner, and radar data, singly or in concert in order to more effectively use these systems. Merge data derived from remote sensing with data derived from conventional sources in geographic information systems to facilitate better environmental planning. Stimulation of the application of the products of remote sensing systems to problems of resource management and environmental quality now being addressed in NASA's Global Habitability directive. The application of remote sensing techniques and analysis and geographic information systems technology to the solution of significant concerns of state and local officials and private industry. The guidance, assistance and stimulation of faculty, staff and students in the utilization of information from the Earth Resources Satellite (LANDSAT) and Aircraft Programs of NASA in research, education, and public service activities carried at the University of Kansas. E.R.

N86-26675# Geological Survey, Reston, Va. National Mapping Div.
RESEARCH, INVESTIGATIONS AND TECHNICAL DEVELOPMENTS: NATIONAL MAPPING PROGRAM, 1983-1984
R. B. MCEWEN 1985 134 p
(PB86-166097; USGS-OFR-85-304) Avail: NTIS HC A07/MF A01 CSCL 08B

Subject areas covered are cartography, photogrammetry and surveying, image mapping, remote sensing, land use and land cover mapping, and geographic information systems. The influence of digital cartographic concepts is found throughout and is leading not only to the automation of map making but to the computer analysis of spatial data, the essence of modern geographic information systems. There are several activities of special interest. These include the 1:100,000-scale digital cartographic data base, the LANDSAT Thematic Mapper image map of Great Salt Lake and Vicinity, the successful testing of the Aerial Profiling of Terrain System, several applications of geographic information systems, and publication of the first chapters of the National Gazetteer of the United States. GRA

N86-27788*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TRANSPORT PROCESSES AS MANIFESTED IN SATELLITE AND LIDAR AEROSOL MEASUREMENTS
M. P. MCCORMICK *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 1 p Dec. 1985
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

A large increase in stratospheric aerosol data has become available recently from the SAM II and SAGE satellite sensors and the impetus from increased volcanic perturbations. Six years of SAM II and nearly 3 years of SAGE measurements have been accumulated. The increase in large volcanic eruptions since 1979 has caused an acceleration of new data sets from worldwide lidars and airborne lidar campaigns and from various airborne in situ measurements. The SAM II and SAGE data sets show the tropical stratosphere as a source for background stratospheric aerosols, and midlatitudes as a possible sink. Analyses of SAM II data show that the aerosol within the northern wintertime polar vortex becomes isolated from the outside. Subsidence occurs within the vortex, changing the vertical aerosol distribution over the winter period. SAM II and SAGE data show that the aerosol is transported in the stratosphere from low to high latitudes in wintertime. Entry regions of tropospheric air in the Tropics are also evident in the SAGE data as shown by stratospheric cirrus clouds being formed well above the local tropopause. Nature has provided over the past 5 years a number of large volcanic eruptions which spewed tons of new aerosol into the stratosphere. These eruptions have occurred at various latitudes which allow transport differences to be studied. Satellite and lidar aerosol data will be used to describe the stratospheric motions of aerosols produced after these violet volcanic eruptions. Author

03

GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A86-33516* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

TOPOGRAPHIC MAPPING FROM INTERFEROMETRIC SYNTHETIC APERTURE RADAR OBSERVATIONS

H. A. ZEBKER and R. M. GOLDSTEIN (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 113-117. refs

Interferometric SAR observations are a basis for the generation of high resolution topographic maps of a region through the interpretation of interference fringes. The combination of height, along-track, and slant range measurements is sufficient for rectification of the radar imagery for cartographic applications, in addition to furnishing an accurate determination of the scene topography. Topographic maps have been derived on the basis of data recorded by both aircraft and Seasat-A satellite radars. A comparison of the maps obtained with U.S. Geological Survey Contour maps indicates a high degree of correlation between two sets of altitude data. O.C.

A86-36099* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

TOPOGRAPHIC MAPPING FROM INTERFEROMETRIC SYNTHETIC APERTURE RADAR OBSERVATIONS

H. A. ZEBKER and R. M. GOLDSTEIN (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, April 10, 1986, p. 4993-4999. NASA-supported research. Previously announced in STAR as N86-10622. refs

The production of high-resolution topographic maps derived from interferometric synthetic aperture radar observations of the earth is reported. Topographic maps are typically determined from stereo-pair optical photographs. Vertical relief causes the same terrain to appear in a slightly different projection for differing look angles, and this shift in appearance is interpreted in terms of the height of the terrain. The radar interferometric approach is related to the stereo technique in that the terrain is viewed at two different angles; however, in this case, the angular separation of the antennas is extremely small, on the order of a milliradian or less, as compared to tens of degrees for the optical case. Thus, the geometrical distortion and subsequent rectification correction algorithms are much less severe in the reduction of interferometric data. R.J.F.

A86-37024* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

LANDSAT THEMATIC MAPPER GEODETIC ACCURACY - IMPLICATIONS FOR GEOCODED MAP COMPATIBILITY

N. A. BRYANT, A. L. ZOBRIST, R. E. WALKER, and B. GOKHMANN (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 226-237. refs

(Contract NAS7-918)

The geodetic accuracy and geometric fidelity of corrected thematic mapper (TM) imagery are evaluated. The positional accuracy requirements for the TM are for a single band to within 0.5 pixels of true earth-surface locations at any point over 90 percent of the image and for interband registration to within 0.3 pixel tolerance over 90 percent of the data. Landsat 4 and 5 TM data are analyzed to investigate: (1) single band geometric integrity, (2) 30 m resolution interband registration; (3) image to image conformity; (4) image to ground conformity; and (5) image projective geometry conformity to a mapped earth geometry. The procedures used to study these characteristics are described. The data reveal that Landsat TM digital data met or exceed map accuracy standards for horizontal control. I.F.

A86-37795* ARCO Oil and Gas Co., Dallas, Tex.

STRUCTURE OF THE SOUTHERN RIO GRANDE RIFT FROM GRAVITY INTERPRETATION

P. H. DAGGETT (ARCO Oil and Gas Co., Exploration and Production Research Dept., Plano, TX), G. R. KELLER, C.-L. WEN (Texas, University, El Paso), and P. MORGAN (Lunar and Planetary Institute, Houston, TX; Purdue University, West Lafayette, IN) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, May 10, 1986, p. 6157-6167. refs

(Contract NSF EAR-70-25371; NASW-3389)

Regional Bouguer gravity anomalies in southern New Mexico have been analyzed by two-dimensional wave number filtering and poly-nomial trend surface analysis of the observed gravity field. A prominent, regional oval-shaped positive gravity anomaly was found to be associated with the southern Rio Grande rift. Computer modeling of three regional gravity profiles suggests that this anomaly is due to crustal thinning beneath the southern Rio Grande rift. These models indicate a 25 to 26-km minimum crustal thickness within the rift and suggest that the rift is underlain by a broad zone of anomalously low-density upper mantle. The southern terminus of the anomalous zone is approximately 50 km southwest of El Paso, Texas. A thinning of the rifted crust of 2-3 km relative to the adjacent Basin and Range province indicates an extension of about 9 percent during the formation of the modern southern Rio Grande rift. This extension estimate is consistent with estimates from other data sources. The crustal thinning and anomalous mantle is thought to result from magmatic activity related to surface volcanism and high heat flow in this area. Author

A86-37797* Cornell Univ., Ithaca, N.Y.

EVIDENCE OF ONGOING CRUSTAL DEFORMATION RELATED TO MAGMATIC ACTIVITY NEAR SOCORRO, NEW MEXICO

S. LARSEN, L. BROWN (Cornell University, Ithaca, NY), and R. REILINGER (USAF, Geophysics Laboratory, Bedford, MA) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, May 10, 1986, p. 6283-6292. refs

(Contract USGS-14-08-0001-20585; NAS5-27232; NAS5-27339)

Leveling measurements conducted in 1980-1981 by the National Geodetic Survey in the Socorro area of the Rio Grande rift are analyzed. Crustal uplift related to magma inflation in the midcrustal magma body is detected; an uplift of 0.18 cm/yr is measured for the time between 1951-1980. The survey data of 1911 and 1959 are compared to the present data and good correlation is observed. The systematic leveling errors including height-dependence and refraction errors are studied. The 30-km-wide subsidence in the area is examined. The spatial correlation between seismic activity, the Socorro magma body, and crustal deformation in Socorro is investigated. The crustal movement from magma reservior activities is modeled using the formulations of Dieterich and Decker (1975). The modeling of the deformation reveals that the movement in the Socorro area is associated with the 19-km deep Socorro magma body. I.F.

N86-26741*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth, Atmospheric and Planetary Studies.

PLATE MOTIONS AND DEFORMATIONS FROM GEOLOGIC AND GEODETIC DATA Semiannual Report, 1 Aug. 1984 - 31 Dec. 1985

T. H. JORDAN 30 Jun. 1986 53 p

(Contract NAG5-459)

(NASA-CR-177299; NAS 1.26:177299) Avail: NTIS HC A04/MF A01 CSCL 08G

Research effort on behalf of the Crustal Dynamics Project focused on the development of methodologies suitable for the analysis of space-geodetic data sets for the estimation of crustal motions, in conjunction with results derived from land-based geodetic data, neo-tectonic studies, and other geophysical data. These methodologies were used to provide estimates of both global plate motions and intraplate deformation in the western U.S. Results from the satellite ranging experiment for the rate of change of the baseline length between San Diego and Quincy, California indicated that relative motion between the North American and Pacific plates over the course of the observing period during 1972 to 1982 were consistent with estimates calculated from geologic data averaged over the past few million years. This result, when combined with other kinematic constraints on western U.S. deformation derived from land-based geodesy, neo-tectonic studies, and other geophysical data, places limits on the possible extension of the Basin and Range province, and implies significant deformation is occurring west of the San Andreas fault. A new methodology was developed to analyze vector-position space-geodetic data to provide estimates of relative vector motions of the observing sites. The algorithm is suitable for the reduction of large, inhomogeneous data sets, and takes into account the full position covariances, errors due to poorly resolved Earth orientation parameters and vertical positions, and reduces baises due to inhomogeneous sampling of the data. This methodology was applied to the problem of estimating the rate-scaling parameter of a global plate tectonic model using satellite laser ranging observations over a five-year interval. The results indicate that the mean rate of global plate motions for that interval are consistent with those averaged over several million years, and are not consistent with quiescent or greatly accelerated plate motions. This methodology was also used to provide constraints on deformation in the western U.S. using very long baseline interferometry observations over a two-year period. M.G.

N86-26745# Ohio State Univ., Columbus. Dept. of Geodetic Science and Surveying.

THE STUDY OF GRAVITY FIELD ESTIMATION PROCEDURES Final Report, 22 Dec. 1981 - 30 Jun. 1985

R. H. RAPP Sep. 1985 12 p refs
(Contract F19628-82-K-0022)
(AD-A164564; AFGL-TR-85-0278) Avail: NTIS HC A02/MF A01 CSCL 08E

The research described includes the use of high degree potential coefficient expansions, vertical datum corrections, improved gravity fields from satellite altimetry, the computation of the gravity vector in space and the use of digital terrain models for gravimetric computations. GRA

N86-27833*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth, Atmospheric and Planetary Sciences.

PLATE MOTIONS AND DEFORMATIONS FROM GEOLOGIC AND GEODETIC DATA Semiannual Report, 1 Aug. 1983 - 31 Dec. 1985

T. H. JORDAN 1986 53 p
(Contract NAG5-459)
(NASA-CR-177313; NAS 1.26:177313) Avail: NTIS HC A04/MF A01 CSCL 08E

A satellite laser ranging experiment conducted by NASA since 1972 has measured the relative motion between the North America and Pacific plates in California. Based on these measurements, the 896-km distance between San Diego and Quincy, California, is shortening at 62 + or - 9 mm/yr. This geodetic estimate is consistent with the rate of motion between the two plates, calculated from geological data to be 53 + or - 3 mm/yr averaged over the past few million years. Author

04

GEOLOGY AND MINERAL RESOURCES

Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology.

A86-30189

USE OF SEASAT SAR IMAGERY FOR GEOLOGICAL MAPPING IN A VOLCANIC TERRAIN - ASKJA CALDERA, ICELAND

J. S. MACKENZIE (Imperial College of Science and Technology, London, England) and P. S. RINGROSE (Strathclyde, University, Glasgow, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Feb. 1986, p. 181-194. Research supported by the University of Edinburgh and Royal Aircraft Establishment.

Nine distinct surface types have been identified by comparison of Seasat SAR imagery with field observations in the Askja Caldera region of central Iceland. A map of radargeological surface type is presented, together with field descriptions and discussion of the influence of the surface types on radar signal return. Surface relief, surface roughness and clast size were found to have the greatest importance for image interpretation. Author

A86-32680

FEATURES OF THE GEOLOGICAL APPLICATION OF SPACE DATA [OSOBENNOSTI GEOLOGICHESKOGO PRIMENENIIA KOSMICHESKOI INFORMATSII]

V. G. TRIFONOV (AN SSSR, Geologicheskii Institut, Moscow, USSR) and S. S. SHULTS (Vsesoiuznyi Geologicheskii Institut, Leningrad, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1986, p. 32-42. In Russian. refs

The information content of spectral signatures is compared to that of geometric signatures with reference to the study of geological formations on the basis of space remote-sensing imagery. The geometric signature of an object includes its shape, structure, and position with respect to other objects on space imagery. Geological formations are characterized by the fact that they are better interpreted by geometric than spectral signature. This calls for a special geology-oriented methodology for the application of space data. B.J.

A86-32681

INTERPRETATION OF RING STRUCTURES ON SPACE IMAGES AND THEIR CORRELATION WITH GEOPHYSICAL FIELDS AND CRUSTAL STRUCTURE IN THE USSR [DESHIFRIROVANIE KOL'TSEVYKH STRUKTUR NA KOSMICHESKIKH SNIMKAKH I IKH KORELIATSIIA S GEOFIZICHESKIMI POLIAMI I STROENIEM ZEMNOI KORY TERRITORII SSSR]

A. T. ZVEREV and IA. G. KATS (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1986, p. 43-50. In Russian. refs

Identified ring structures in the USSR are correlated with geological and geophysical features as well as with the associated lithospheric characteristics. The correlation analysis indicates that the ring structures are deep-lying and have a long evolutionary history. In addition, they are found to exhibit a higher concentration in areas with a thinner and older crust, a higher rock density, and a stronger heat flux. B.J.

A86-32682

APPLICATION OF SPACE IMAGERY TO THE IDENTIFICATION AND GEOLOGICAL-GEOPHYSICAL STUDY OF HIDDEN PLUTONS IN EARLY PROTEROZOIC TROUGHS [ISPOL'ZOVANIE KOSMICHESKIKH SNIMKOV PRI VYIAVLENII I GEOLOGO-GEOFIZICHESKOM IZUCHENII SKRYTYKH PLUTONOV V RANNEPROTEROZOISKIKH TROGAKH]

D. M. TROFIMOV, N. A. STRAKHOVA, V. A. BOGOSLOVSKII, E. B. ILINA, V. A. KAZANTSEV (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) et al. Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1986, p. 51-56. In Russian.

Space imagery was used to identify and examine hidden plutons in the early Proterozoic troughs of the central Kursk Magnetic Anomaly. It is shown that intersections of faults identified on space images are related to sulfide mineralization. It is noted that the method used can be applied to mineral prospecting in the sedimentary cover basement. B.J.

A86-32690

COMPUTER-AIDED INTERPRETATION OF SPACE IMAGES WITH THE AIM OF STRUCTURAL ANALYSIS [AVTOMATIZIROVANNOE DESHIFRIROVANIE KOSMICHESKIKH SNIMKOV S TSEL'IU STRUKTURNOGO ANALIZA]

N. V. KORONOVSKII, A. A. ZLATOPOLSKII, and G. N. IVANCHENKO (Moskovskii Gosudarstvennyi Universitet; Proizvodstvennoe Geologicheskoe Ob'edinenie Aerogeologiia, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1986, p. 111-118. In Russian.

Landsat imagery of the eastern Caucasus was interpreted using special-purpose computer programs to facilitate the structural analysis of the region. Some of the linear elements identified were rejected, while others were combined into lineament zones. Most of the lineaments were found to coincide with those identified by visual interpretation. It is noted that the proposed method can be used for the quick-look assessment of tectonic deformations. B.J.

A86-33517

PHOTOGRAMMETRY AND REMOTE SENSING IN PERIGLACIAL GEOMORPHOLOGY

W. G. HOWLAND (Middlebury College, VT) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 119-124.

Remote sensing and photogrammetry are seldom effectively applied in geomorphic research. However, instruments, imagery and techniques, which have recently become far more accessible than previously, can provide a quantitative basis for the assessment of terrain morphology, and greatly aid the analysis of geomorphic processes. This paper describes the use of existing technology in ways that directly aid in geomorphic research, and provides an example concerning an Arctic study area. The first part (A) of the paper discusses techniques in the general context of geomorphology, while the second part (B) shows, with a case study, the applicability of these techniques. Author

A86-33518

TOPOGRAPHIC LINEAMENT DOMAINS OF THE APPALACHIANS - SOME NEW METHODS AND TECHNIQUES FOR PALEOSTRESS ANALYSIS

D. U. WISE, L. T. GRADY (Massachusetts, University, Amherst), and F. SALVINI (Pisa, Universita, Italy) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 125-130.

The method of Wise et al. (1985) for the analysis of geologic lineaments on remotely sensed images is applied to the Appalachian chain. The technique emphasizes subparallel lineament swarms and their map domains rather than individual lines. The basic data are derived from mosaics of side-lighted photographs of raised relief maps of the Appalachians. These maps provide a filter, leaving only the most prominent and well developed topographic linears as a subset of the many classes of linear features that are imbedded in a typical Landsat or radar image. Six different mosaics of these maps were produced, illuminated from six different azimuths. Data analyses involved automatic fitting of Gaussian peaks to azimuth-frequency histograms. The origins of the local lineament domains obtained, which represent regional or subregional scale features, and as such must have been created by paleostress fields of at least comparable size, are discussed. I.S.

A86-33519

A PRELIMINARY ANALYSIS OF LANDSAT MSS AND TM DATA IN THE LEVACK AREA, SUDBURY, CANADA

J. K. HORNSBY (Intera Technologies, Ltd., Calgary, Canada) and B. BRUCE (Canada Centre for Remote Sensing, Ottawa, Canada) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 131-140. refs

The results of preliminary digital analysis of Landsat's MSS and TM imagery is presented for lineament and lithologic interpretation in the copper-nickel producing Levack area of the Sudbury Basin in Canada. The digital analysis methodology involves the production of a series of band combination enhancements and classification products, used as the bases for comparative visual geological interpretation and feature compilation. The results of the study indicated that the MSS and TM data show more geologic structure within the study area than was previously mapped. Both types of data allow the interpretation of the same major structures, but the TM data reveal more curvilinear and linear features than the MSS data, offer greater detail at points of intersection, and provide a more continuous record of a particular linear across an image. Both the MSS and TM were capable of discriminating the major lithologic units of the Sudbury Igneous Complex, felsic intrusives, and the metavolcanic-metasedimentary belt to the north. Although the TM data display greater spectral variability and provide a more detailed classification, the MSS data yield consistent results and would likely be more cost effective for large area reconnaissance. I.S.

A86-33520

LINEAMENT ANALYSIS IN A TEST AREA OF NORTHERN MOZAMBIQUE

M. POSCOLIERI and S. SALVI (CNR, Istituto di Astrofisica Spaziale, Frascati, Italy) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 141-146. refs

Lineament analysis for a test area in northern Mozambique, is presented. The lineaments have been interpreted from a Landsat 2 picture and then digitized. A procedure was developed, based on statistical and analytical methods, for processing large amount of linear data sets, in which the numerical matrices representing the areal density of the structural domains are displayed by contour line maps. These maps allow the identification of regional structural trends suitable for mineral exploration and may be utilized as a check for the precision of the existing geological maps derived by other methods. The results of a comparison of the contour maps with the geological map and the map of the mining districts are discussed. I.S.

A86-33521* Brown Univ., Providence, R. I.

SPECTROSCOPY OF MOSES ROCK DIKE USING REMOTE SENSING

J. F. MUSTARD and C. M. PIETERS (Brown University, Providence, RI) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 147-152. refs
(Contract NASW-4048)

Zeiss IR-photographs, NS0001 (TM simulator) and airborne imaging spectrometer (AIS) data were obtained for the Moses Rock kimberlite dike in southern Utah to identify and characterize the distinctive mafic mineralogy of the dike as well as the surrounding sedimentary rocks. The Zeiss and NS001 images provide information on the regional setting and allow units of the dike to be distinguished from the sediments. The AIS data are narrow images obtained in 128 near-infrared channels and provide characterizing information on the surface composition through. Three distinct spectroscopic units were found which have been tentatively identified as serpentized olivine-bearing soils found in the dike and two types of gypsum bearing soils found in the surrounding sedimentary soils. Author

A86-33550* Hawaii Univ., Honolulu.

PRELIMINARY GEOLOGIC ANALYSES OF SIR-B RADAR DATA FOR HAWAII

L. R. GADDIS, P. J. MOUGINIS-MARK (Hawaii, University, Honolulu), V. H. KAUPP, H. C. MACDONALD, and W. P. WAITE (Arkansas, University, Fayetteville) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 364-369. refs
(Contract JPL-956925)

A number of distinct topographic and textural units were discerned on SIR-B radar images of the Kilauea/Kau Desert area. The SIR-B enhanced large-scale topographic features, such as the Kahuku Pali and the Koae Faults (both oriented towards the radar antenna), while it was unable to detect features facing away from the radar antenna such as the Hilina and Kaoiki Pali. Textural units which were identified on the SIR-B images include aa flows of various ages, and several pyroclastic units. The extreme surface roughness of aa flows produced high radar returns on both the 28 deg and 48 deg SIR-B data sets. In contrast, pahoehoe flows produced smooth, low return units which were difficult to distinguish from surrounding radar-dark materials. It is suggested that multilook direction data, acquired at steeper incidence angles during a reflight of SIR-B, may aid in the further identification of pahoehoe flows and subtle topographic features. K.K.

A86-33551

INTRODUCTORY ANALYSES OF SIR-B RADAR DATA FOR HAWAII

B. A. DERRYBERRY, V. H. KAUPP, H. C. MACDONALD, W. P. WAITE (Arkansas, University, Fayetteville), L. R. GADDIS (Hawaii, University, Honolulu) et al. IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 370-375.

Two synthetic aperture radar (SAR) images of the Kilauea Volcano/Kau Desert were obtained and used, together with surface roughness measurements, to model the interaction between an incident wave and a volcanic surface. An analysis relating lava flow type and age was performed using Shuttle imaging radar (SIR-B) data. Mean, variance, and histogram were used to discriminate between aa and pahoehoe surfaces of differing ages. It was demonstrated that the extreme roughness and blockiness of aa flows produce both distinctively high returns on radar images and histograms characteristic of nonideal scattering surfaces. Pahoehoe flows, by contrast, are smooth low-return features, which are difficult to distinguish from surrounding radar-dark materials, and appear to be nerly ideal scattering surfaces. K.K.

A86-33552* Brown Univ., Providence, R. I.

STRUCTURE OF TERRESTRIAL IMPACT CRATERS FROM SIR-B RADAR DATA - PRELIMINARY RESULTS

P. C. FISHER, J. W. HEAD (Brown University, Providence, RI), S. H. ZISK (Haystack Observatory, Westford, MA), R. A. F. GRIEVE (Department of Energy, Mines, and Resources, Earth Physics Branch, Ottawa, Canada), and K. SULLIVAN (NASA, Johnson Space Center, Houston, TX) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 376, 377.

The structure in and around the Charlevoix and Deep Bay impact craters was analyzed by comparing SIR-B radar image lineament maps with maps derived from Landsat data and aerial photography. Relationships revealed include the discovery in the Deep Bay lineament distribution of a mode, of slightly different location and size to that determined by aerial photography, which correlates with the regional glacial trend. The Deep Bay regional glacial trend displays a much more prominent signature in the aerial photography than in the radar data, confirming the influence of radar look direction on the interpretation of lineament distribution and orientation. Effects from the impact event are noted in the radar images of both craters, with lineaments of one km or less appearing to be associated with the rim structure. R.R.

A86-33592* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

WHAT ARE THE BEST RADAR WAVELENGTHS, INCIDENCE ANGLES AND POLARIZATIONS FOR GEOLOGIC APPLICATIONS? A STATISTICAL APPROACH

R. BLOM (California Institute of Technology, Jet Propulsion Laboratory, Pasadena; California, University, Santa Barbara), L. SCHENCK, and R. ALLEY (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 659-664. NASA-sponsored research.

Linear discriminant analysis of multifrequency and multipolarization radar scatterometer data of lava flows and sedimentary rocks indicates that the lava flows can be separated by age and the sedimentary rocks can be discriminated from one another. The optimum wavelengths, polarizations and incidence angles among those available for these problems was determined by the discriminant analysis program. For separation of the lava flows, shorter wavelengths, smaller incidence angles and horizontal polarization are best. A SIR-C radar configuration could provide nearly complete discrimination of these lava flows. Conversely, the longer wavelengths, larger incidence angles and vertical polarization was preferred for sedimentary rocks, perhaps due to the slight vegetation cover. Satisfactory classification of sedimentary rocks requires more radar data than for the lavas. These results are potentially useful both for radar system configuration and for geological applications. The method developed here may provide a rationale for user specification of imaging system parameters. Author

A86-33593

ANALYSIS OF L-BAND MULTIPOLARIZATION RADAR IAMGES FOR LAVA FLOW MAPPING

V. H. KAUPP, R. E. CHILTON, H. C. MACDONALD, W. P. WAITE (Arkansas, University, Fayetteville), L. R. GADDIS (Hawaii, University, Honolulu) et al. IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 669-675. refs

Multipolarization radar iamges of the Medicine Lake Highland, CA, area were obtained in support of the SIR-B (Shuttle imaging radar) program by the JPL aircraft SAR (synthetic aperture radar). These images have been evaluated in an attempt to determine the influences of polarization on lava flow mapping. Images of all four polarizations (HH, HV, VH, and VV) of the region were available. In studying nine flows, the VV images provided the best

discrimination in almost all cases. A color composite created from the HH, VV, and VH images was evaluated for each scene, and despite range tonal variations it is seen that discrimination of flows is accomplished more easily using the composites. The incremental value of the cross polarized return cannot be evaluated with this small amount of data, and a more extensive study is needed.
D.H.

A86-35676

STATISTICAL LINEAMENT ANALYSIS IN SOUTH GREENLAND BASED ON LANDSAT IMAGERY

K. CONRADSEN (Danmarks Tekniske Hojskole, Lyngby, Denmark), G. NILSSON (Telelogic AB, Malmo, Sweden), and T. THYRSTED (Gronlands Geologiske Undersogelse, Copenhagen, Denmark) (International Geoscience and Remote Sensing Symposium /IGARSS '84/: From Research toward Operational Use, Strasbourg, France, Aug. 27-30, 1984) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, May 1986, p. 313-321. refs

Linear features, mapped visually from MSS channel-7 photoprints (1:1,000,000) of Landsat images from South Greenland, were digitized and analyzed statistically. A sinusoidal curve was fitted to the frequency distribution which was then divided into ten significant classes of azimuthal trends. Maps showing the density of linear features for each of the ten classes indicate that many of the classes are distributed in zones defined by elongate maxima or rows of maxima. In cases where the elongate maxima and the linear feature direction of the class in question are parallel, a zone of major crustal discontinuity is inferred. In the area investigated, such zones coincide with geochemical boundaries and graben structures, and the intersections of some zones seem to control intrusion sites. In cases where there is no parallelism between the elongate maxima and the linear feature direction, an en echelon pattern of the lineaments may be inferred. Author

A86-36083* Kansas Univ., Lawrence.

GEOLOGICAL MAPPING POTENTIAL OF COMPUTER-ENHANCED IMAGES FROM THE SHUTTLE IMAGING RADAR - LISBON VALLEY ANTICLINE, UTAH

J. D. CURLIS, V. S. FROST, and L. F. DELLWIG (Kansas, University, Lawrence) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, April 1986, p. 525-532. Research supported by Phillips Petroleum Co., American Association of Petroleum Geologists, and University of Kansas. refs
(Contract JPL-954946)

Computer-enhancement techniques applied to the SIR-A data from the Lisbon Valley area in the northern portion of the Paradox basin increased the value of the imagery in the development of geologically useful maps. The enhancement techniques include filtering to remove image speckle from the SIR-A data and combining these data with Landsat multispectral scanner data. A method well-suited for the combination of the data sets utilized a three-dimensional domain defined by intensity-hue-saturation (IHS) coordinates. Such a system allows the Landsat data to modulate image intensity, while the SIR-A data control image hue and saturation. Whereas the addition of Landsat data to the SIR-A image by means of a pixel-by-pixel ratio accentuated textural variations within the image, the addition of color to the combined images enabled isolation of areas in which gray-tone contrast was minimal. This isolation resulted in a more precise definition of stratigraphic units. Author

A86-36501

METHODS OF COMBINED AIR AND SPACE REMOTE-SENSING STUDIES OF SIBERIA [METODY KOMPLEKSNYKH AEROKOSMICHESKIKH ISSLEDOVANII SIBIRI]

L. K. ZIATKOVA, ED. Novosibirsk, Izdatel'stvo Nauka, 1985, 96 p. In Russian. For individual items see A86-36502 to A86-36518.

The use of remote-sensing techniques to solve geological problems is considered along with the computer-aided processing of remote-sensing images. Particular consideration is given to the contribution of remote sensing to the development of structural geomorphology; the quantitative assessment of the information content of TV images obtained in remote-sensing studies of Siberia; the remote sensing of transition zones of the junction of Siberian platforms and orogens; a combined approach to oil and gas exploration in the southern Permsk region; the application of image-analysis software to environment-protection problems; and the choice of spectral bands for a spaceborne multispectral scanner. B.J.

A86-36502

PROBLEMS AND PRINCIPLES OF THE GEOLOGICAL INTERPRETATION OF REMOTE-SENSING DATA [PROBLEMY I PRINTSIPY GEOLOGICHESKOI INTERPRETATSII REZUL'TATOV DESHIFRIROVANIIA DISTANTSIONNYKH MATERIALOV]

D. M. TROFIMOV IN: Methods of combined air and space remote-sensing studies of Siberia . Novosibirsk, Izdatel'stvo Nauka, 1985, p. 5-8. In Russian.

Principles of the multilevel geological interpretation of aerial and space remote-sensing data are examined. The interpretation is based on the spatial correlation of remote-sensing images of geological objects observed on photographs, as well as on the basis of geological-geophysical data, taking the density of initial information into account. The interpretation involves successive approximation to the object, generating the remote-sensing or landscape image from top to bottom, from the more studied to the less studied 'horizons' of the earth crust. B.J.

A86-36503

COMBINED STRUCTURAL AND GEOMORPHOLOGICAL METHODS FOR THE PROCESSING OF AERIAL AND SPACE PHOTOGRAPHIC REMOTE-SENSING DATA WITH THE AIM OF SOLVING GEOLOGICAL PROBLEMS [KOMPLEKSNYE STRUKTURNO-GEOMORFOLOGICHESKIE METODY OBRABOTKI AEROKOSMICHESKOI FOTOINFORMATSII DLIA RESHENIIA GEOLOGICHESKIKH ZADACH]

L. K. ZIATKOVA IN: Methods of combined air and space remote-sensing studies of Siberia . Novosibirsk, Izdatel'stvo Nauka, 1985, p. 9-19. In Russian. refs

The paper examines aspects of the development of a combined system for the instrumented, automated processing of aerial and space remote-sensing data with the aim of recognizing various types of tectonic and seismic structures and exploring for fossil fuels and ore deposits. The approach used involves the identification of the interpretation features and morphometric characteristics connected with water divides and river basins.
B.J.

A86-36504

INVESTIGATION OF THE EARTH FROM SPACE - A NEW CONTRIBUTION TO THE DEVELOPMENT OF STRUCTURAL GEOMORPHOLOGY [ISSLEDOVANIIA ZEMLI IZ KOSMOSA - NOVYI VKLAD V RAZVITIE STRUKTURNOI GEOMORFOLOGII]

A. P. KULAKOV IN: Methods of combined air and space remote-sensing studies of Siberia . Novosibirsk, Izdatel'stvo Nauka, 1985, p. 19-22. In Russian. refs

It is noted that space remote-sensing data have produced a 'revolution' in morphostructural studies, and have led to a number of new ideas in the area of morphological analysis and synthesis. In particular, the ubiquitous development on the earth of morphostructures of a central type, with diameters up to several thousand kilometers, has been established. In addition, previously undetected transregional fault zones (lineaments) have been observed. .
B.J.

A86-36505

METHOD FOR THE QUANTITATIVE ESTIMATION OF CONVERGENCE IN MAPPING IN THE CASE OF THE INTERPRETATION OF SPACE PHOTOGRAPHS OF OIL-AND-GAS-BEARING REGIONS OF SIBERIA [METOD KOLICHESTVENNOI OTSENKI SKHODIMOSTI V KARTOGRAFICHESKIKH POSTROENIIAKH PRI DESHIFRIROVANII KOSMOSNIMKOV NEFTEGAZONOSNYKH RAIONOV SIBIRI]

A. M. BOROVIKOV and L. M. SHEMIAKIN IN: Methods of combined air and space remote-sensing studies of Siberia . Novosibirsk, Izdatel'stvo Nauka, 1985, p. 22-30. In Russian. refs

A86-36506

QUANTITATIVE ASSESSMENT OF THE INFORMATION CONTENT OF TV IMAGES OF DIFFERENT SCALE ON THE EXAMPLE OF DISJUNCTIVES OF SIBERIA [KOLICHESTVENNAIA OTSENKA INFORMATIVNOSTI RAZNOMASSHTABNYKH TELESNIMKOV NA PRIMERE DIZ'IUNKTIVOV SIBIRI]

V. I. VITIAZ and V. IA. EROMENKO IN: Methods of combined air and space remote-sensing studies of Siberia . Novosibirsk, Izdatel'stvo Nauka, 1985, p. 30-34. In Russian.

The interpretation of ultrasmall-scale and small-scale TV images of platform regions of Siberia is examined along with the interpretation of small-scale space imagery. Linear, ring-shaped, and arclike elements on interregional and regional scales are identified. The regional features of western and eastern Siberia are manifested in the large relative density of lineaments on the Siberian platform. B.J.

A86-36507

METHODS FOR THE REMOTE SENSING OF TRANSITION ZONES OF THE JUNCTION OF SIBERIAN PLATFORMS AND OROGENS [METODY DISTANTSIONNYKH ISSLEDOVANII PEREKHODNYKH ZON SOCHLENENIIA PLATFORM I OROGENOV SIBIRI]

L. K. ZIATKOVA IN: Methods of combined air and space remote-sensing studies of Siberia . Novosibirsk, Izdatel'stvo Nauka, 1985, p. 35-41. In Russian. refs

The paper examines the use of space-image interpretation techniques to identify various structures in zones joining Siberian platforms and orogens. It is shown that such junction zones should be considered as a combination of various types of platform and orogenic structures, subjected to endodynamic, exodynamic, hypergenoexodynamic, and technogenoanthropogenic processes. B.J.

A86-36508

THE USE OF REMOTE-SENSING DATA TO PREDICT REGIONAL AND LOCAL OIL-AND-GAS-BEARING STRUCTURES WITHIN THE DNEPROVSK-DONETSK PALEORIFT [OPYT PRIMENENIIA KOSMICHESKOI INFORMATSII DLIA PROGNOZIROVANIIA REGIONAL'NYKH I LOKAL'NYKH NEFTEGAZONOSNYKH STRUKTUR V PREDELAKH DNEPROVSKO-DONETSKOGO PALEORIFTA]

V. K. GAVRISH, A. I. NEDOSHOVENKO, E. S. PETROVA, and V. N. DEMENTEV IN: Methods of combined air and space remote-sensing studies of Siberia . Novosibirsk, Izdatel'stvo Nauka, 1985, p. 42-47. In Russian. refs

A86-36509

COMBINATION OF AIR AND SPACE REMOTE-SENSING METHODS AND GEOLOGICAL-GEOPHYSICAL METHODS FOR THE PURPOSE OF OIL AND GAS EXPLORATION IN THE SOUTHERN PERMSK REGION [KOMPLEKSIROVANIE AERO-KOSMOGEOLOGICHESKIKH I GEOLOGO-GEOFIZICHESKIKH METODOV PRI NEFTEGAZOPOISKOVYKH RABOTAKH NA IUGE PERMSKOI OBLASTI]

IU. A. DULEPOV, V. V. MAKALOVSKII, V. S. KUROCHKIN, and V. G. GATSKOV IN: Methods of combined air and space remote-sensing studies of Siberia . Novosibirsk, Izdatel'stvo Nauka, 1985, p. 48-52. In Russian.

A86-36510

ASPECTS OF THE GEOLOGICAL INTERPRETATION OF GEOPHYSICAL FIELDS AND RESULTS OF AIR AND SPACE REMOTE SENSING OBSERVATIONS OF OIL-AND-GAS-BEARING TERRITORIES [NEKOTORYE VOPROSY GEOLOGICHESKOI INTERPRETATSII GEOFIZICHESKIKH POLEI I REZUL'TATOV AEROKOSMICHESKIKH NABLIUDENII NEFTEGAZONOSNYKH TERRITORII]

V. V. PANASENKO and V. N. PANASENKO IN: Methods of combined air and space remote-sensing studies of Siberia . Novosibirsk, Izdatel'stvo Nauka, 1985, p. 52-56. In Russian. refs

A86-37009

DIRECTION DEPENDENT INTERPOLATION OF AEROMAGNETIC DATA

L. BRINDT and H. HAUSKA (Lulea, Hogskolan, Sweden) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 86-95. Sponsorship: Styrelsen for Teknisk Utveckling and Swedish Board for Space Activities. refs

(Contract STU-83-4119; SBSA-63-83; SBSA-56-84)

The paper describes a method for level correction and interpolation of anisotropically sampled aeromagnetic data. The level correction is based on piecewise comparison of adjacent flightlines. The interpolation scheme is based on cubic splines and preserves thin linear structures in anisotropic potential field data. The design of such a method is an important building stone for the design of an image-based information system for geologic applications. Author

A86-37021

LANDSAT MSS AND AIRBORNE GEOPHYSICAL DATA COMBINED FOR MAPPING GRANITE IN SOUTHWEST NOVA SCOTIA

V. R. SLANEY (Geological Survey of Canada, Ottawa) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 198-206. refs .

A86-37865#

APPLICATION OF SPACEBORNE AND AIRBORNE TECHNIQUES IN MINERAL EXPLORATION AT WADI EL ALLAQI AREA, EASTERN DESERT, EGYPT

E. M. EL SHAZLY, M. A. A. HADY, and A. F. EL NASHARTY (Academy of Scientific Research and Technology, Remote Sensing Centre, Cairo, Egypt) IN: International Conference on Space, 25th, Rome, Italy, March 26-28, 1985, Proceedings . Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1985, p. 217-224. refs

N86-23030# Office of Technology Assessment, Washington, D.C.
OIL AND GAS TECHNOLOGIES FOR THE ARCTIC AND DEEPWATER
May 1985 235 p
(PB86-119948) Avail: NTIS HC A11/MF A01 CSCL 08I

Nearly 2 billion acres of offshore public domain is owned by the United States adjacent to Alaska and the lower 48 states. Much of the Nation's future domestic petroleum supply is expected to come from this area. Areas of highest potential apparently occur in deeper water and in the Arctic where operating conditions are severe, development costs high, and financial risks immense. As the pace of exploration increases in these frontier regions, questions arise about the technologies needed to safely and efficiently explore and develop oil and gas in harsh environments. The study explores the range of technologies required for exploration and development of offshore energy resources and assesses associated economic factors and financial risks. GRA

N86-25099# Geological Survey, Reston, Va.
REMOTE MONITORING OF PROCESSES THAT SHAPE DESERT SURFACES: THE DESERT WINDS PROJECT
J. F. MCCAULEY, C. S. BREED, P. J. HELM, G. H. BILLINGSLEY, D. J. MACKINNON, M. J. GROLIER, and C. K. MCCAULEY (Museum of Northern Arizona, Flagstaff) 1985 23 p refs
(TI86-900108; USGS-BULL-1634; LC-84-601115) Avail: NTIS HC A02/MF A01

Investigations of wind as a geologic agent have been hampered by a scarcity of long-term onsite measurements of wind velocity (including peak gusts, direction, and periodicity), precipitation frequency and intensity, relative humidity, and soil and air temperatures in key desert localities. A new long-term study, using data obtained by meteorologic and geologic sensors coupled to nonattended solar-powered data-collector platforms is described. Data obtained from these geometeorologic (Geomet) stations in desert type areas of Arizona are automatically relayed by the Geostationary Operational Environmental Satellite (GOES) to the U.S. Geological survey in Flagstaff, Ariz., in real time, and converted to graphic form. Preliminary computer analysis of the data indicates strikingly different meteorologic patterns that control, in great part, the local surficial geology of different desert areas. Author

N86-25866*# Lunar and Planetary Inst., Houston, Tex.
THEMATIC MAPPER STUDIES OF ANDEAN VOLCANOES Monthly Report
P. W. FRANCIS 1986 13 p Original contains color illustrations
(Contract NAS5-28759)
(NASA-CR-176807; NAS 1.26:176807; MR-6) Avail: NTIS HC A02/MF A01 CSCL 08K

The primary objective was to identify all the active volcanoes in the Andean region of Bolivia. Morphological features of the Tata Sabaya volcano, Bolivia, were studied with the thematic mapper. Details include marginal levees on lava and pyroclastic flows, and summit crater structure. Valley glacier moraine deposits, not easily identified on the multispectral band scanner, were also unambiguous, and provide useful marker horizons on large volcanic edifices which were built up in preglacial times but which were active subsequently. With such high resolution imagery, it is not only possible to identify potentially active volcanoes, but also to use standard photogeological interpretation to outline the history of individual volcanoes. B.G.

N86-25912*# Nevada Univ., Reno. Dept. of Geological Sciences.
THE NATURE AND ORIGIN OF MINERAL COATINGS ON VOLCANIC ROCKS OF THE BLACK MOUNTAIN, STONEWALL MOUNTAIN AND KANE SPRINGS WASH VOLCANIC CENTERS IN SOUTHERN NEVADA Semiannual Progress Report, Jul. 1985 - Jan. 1986
J. V. TARANIK, D. D. NOBLE, L. C. HSU, and A. HUTSINPILLER
Jan. 1986 23 p refs Original contains color illustrations
(Contract NAS5-28765)
(NASA-CR-176805; NAS 1.26:176805) Avail: NTIS HC A02/MF A01 CSCL 08G

Four LANDSAT thematic mapping scenes in southern Nevada were requested at two different acquisition times in order to assess the effect of vegetation on the signature of the volcanic units. The remote sensing data acquisition and analysis portion are nearly completed. The LANDSAT thematic mapping data is of good quality, and image analysis techniques are so far successful in delineating areas with distinct spectral characteristics. Spectrally distinct areas were correlated with variations in surface coating and lithologies of the volcanic rocks. Author

N86-26740*# Bechtel National, Inc., San Francisco, Calif.
THEMATIC MAPPER RESEARCH IN THE EARTH SCIENCES: TECTONIC EVALUATION OF THE NUBIAN SHIELD OF NORTHEASTERN SUDAN/SOUTHEASTERN EGYPT USING THEMATIC MAPPER IMAGERY Interim Report
Feb. 1986 24 p refs Original contains color illustrations
(Contract NAS5-28757)
(NASA-CR-177311; NAS 1.26:177311) Avail: NTIS HC A02/MF A01 CSCL 08G

The tectonic evaluation of the Nubian Shield using the Thematic Mapper (TM) imagery is progressing well and shows great promise. The TM tapes for the six LANDSAT 5 scenes covering the northern portion of the Red Sea hills were received, and preliminary maps and interpretations were made for most of the area. It is apparent that faulting and shearing associated with the major suture zones such as the Sol Hamed are clearly visible and that considerable detail can be seen. An entire quadrant of scene 173,45 was examined in detail using all seven bands, and every band combination was evaluated to best display the geology. A comparison was done with color ratio combinations and color combinations of the eigen vector bands to verify if band combinations of 7-red, 4-green, and 2-blue were indeed superior. There is no single optimum enhancement which provides the greatest detail for every image and no single combination of spectral bands for all cases, although bands 7, 4, and 2 do provide the best overall display. The color combination of the eigen vector bands proved useful in distinguishing fine detailed features. B.G.

05

OCEANOGRAPHY AND MARINE RESOURCES

Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location.

A86-31350
INTEGRATED GLOBAL MONITORING OF THE WORLD OCEAN. VOLUMES 1, 2, & 3 [KOMPLEKSNYI GLOBAL'NYI MONITORING MIROVOGO OKEANA. VOLUMES 1, 2, & 3]
IU. A. IZRAEL, ED. Leningrad, Gidrometeoizdat, 1985, 1134 p. In Russian. No individual items are abstracted in these volumes.

Papers from the First International Symposium on Integrated Global Monitoring of the World Ocean (Tallin, 1983) are presented. Reports from various international organizations are presented. Particular topics include: the scientific foundations of the ecological monitoring of the ocean; methods for the assessment of ocean pollution; the effect of atmospheric transport on ocean pollution; the ecological consequences of ocean pollution; and biogeochemical cycles and balances of pollutants. Consideration is also given to the monitoring of heat transfer in the ocean and between the atmosphere and the ocean, and to ocean modeling. B.J.

A86-31976

EVIDENCE FOR SMALL-SCALE MANTLE CONVECTION FROM SEASAT ALTIMETER DATA

W. F. HAXBY and J. K. WEISSEL (Lamont-Doherty Geological Observatory, Palisades, NY) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, March 10, 1986, p. 3507-3520. refs
(Contract N00014-80-C-0098; N00014-84-C-0132; NSF OCE-82-02454; NSF OCE-82-08927)

The present paper has mainly the objective to draw attention to singular but subtle patterns of gravity undulations, taking into account their association with the younger portions of fast-moving oceanic plates. The explanation is proposed that these gravity features reflect the development, through instability in the thermal boundary layer, of small-scale mantle convection which is organized into longitudinal rolls by shear imparted fast-moving plates. From the crustal age at which the lineated gravity patterns become discernable it is inferred that small-scale convection becomes established within 5-10 m.y. after initiation of plate cooling. Attention is given to new information from Seasat altimeter data, other geophysical data, and implications for convection in the mantle. G.R.

A86-32267

THE EFFECTIVE ELASTIC LITHOSPHERE UNDER THE COOK-AUSTRAL AND SOCIETY ISLANDS

S. CALMANT and A. CAZENAVE (CNES, Groupe de Recherche de Geodesie Spatiale, Toulouse, France) Earth and Planetary Science Letters (ISSN 0012-821X), vol. 77, no. 2, March 1986, p. 187-202. Research supported by the Institut National des Sciences de l'Univers and CNES. refs

The elastic thickness, Te, of the oceanic lithosphere along the volcanic chains of Cook-Austral and Society islands was determined, using a three-dimensional spatial method to model the lithospheric flexure and assuming a continuous elastic plate. The model was constrained by geoid height data from the Seasat satellite. When the Society and Cook-Austral Te results versus age of load are plotted together, it becomes obvious that within the first five-million years after loading, Te decreases significantly while tending rapidly to an equilibrium value. This may be interpreted as the effect of initial stress relaxation which occurs just after loading inside the lower lithosphere and suggests that the presently measured elastic thickness under the very young Tahiti load (about 0.8 Ma) is not yet the equilibrium thickness. I.S.

A86-32556*# National Aeronautics and Space Administration, Washington, D.C.

THE OCEAN TOPOGRAPHY EXPERIMENT (TOPEX) - SOME QUESTIONS ANSWERED

W. F. TOWNSEND (NASA, Washington, DC) IN: EASCON '85: National space strategy - A progress report; Proceedings to the Eighteenth Annual Electronics and Aerospace Systems Conference, Washington, DC, October 28-30, 1985 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 293-296.

The Ocean Topography Experiment (TOPEX) is to provide a basis for improving the understanding of the general circulation of the global oceans. In the context of this experiment, measurements of the surface topography of the oceans are to be conducted with the aid of radar altimetry. The obtained data, when combined with appropriate in situ observations, will make it possible to determine the three-dimensional structure of the ocean currents. The in situ observations needed are to be provided by the World Ocean Circulation Experiment (WOCE). Information regarding the ocean surface winds obtained with the aid of the NASA Scatterometer (NSCAT) to be flown on the Navy Remote Ocean Sensing System (N-ROSS) can supplement the TOPEX and WOCE data about the oceans. The TOPEX satellite is to be designed for a three year lifetime, but it will carry expendables for two additional years. Attention is given to TOPEX as an international program, aspects of timing regarding the conduction of the various experiments dealing with the oceans and the global climate, and the special characteristics of the TOPEX mission. G.R.

A86-32599#

OPEN OCEAN RADAR SEA SCATTER MEASUREMENTS

D. B. TRIZNA (U.S. Navy, Naval Research Laboratory, Washington, DC) IN: International Radar Conference, Arlington, VA, May 6-9, 1985, Record . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 135-140. refs

Measurements are reported of shipboard X-band radar sea scatter for a variety of wind speeds, collected over 360 degrees in azimuth using horizontal polarization. The data were sorted by azimuth and statistics are reported for the upwind aspect. These are fit well by a double Weibull distribution, similar to that reported by Hansen and Cavaleri. The scattering mechanisms responsible for this double distribution are suggested to be Bragg scatter and sea spikes. Results of correlating the parameters of these distributions against environmental parameters which were collected aboard the research vessel are presented. Author

A86-32635

THE DESIGN, CONSTRUCTION AND EARLY TRIALS OF A NOVEL AIRBORNE SURVEILLANCE RADAR

J. G. SCHOENENBERGER and P. D. L. WILLIAMS (Racal-Decca Advanced Development, Ltd., Walton-on-Thames, England) IN: International Radar Conference, Arlington, VA, May 6-9, 1985, Record . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 372-377. refs

Attention is given to a novel airborne surveillance radar that originated in a conventional pulse radar carried under a variety of test aircraft and which was then upgraded to SLAR equipment incorporating a bandwidth processor for the real time recording of images on an inexpensive audio tape deck. Ocean surface imagery of reasonable quality has been obtained by these means. The system is expected to be useful in searches for patterns of shipping and features such as oil slicks and thermal currents in disturbed water. O.C.

A86-32676

NEAR-SURFACE WATER CIRCULATION IN THE SUB-ARCTIC FRONTAL ZONE (ACCORDING TO SATELLITE DATA) [O PRIPOVERKHNOSTNOI TSIRKULIATSII VOD V SUBARKTICHESKOI FRONTAL'NOI ZONE /PO DANNYM ISZ/]

A. I. GINZBURG and K. N. FEDOROV (AN SSSR, Institut Okeanologii, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1986, p. 8-13. In Russian. refs

Two satellite images, one taken in the IR and the other taken in the visible, of the region bounded by Hokkaido and sub-Arctic waters on the north, Honsu Island on the west, and the main Kuroshio front on the south are analyzed. The IR image was obtained with the NOAA-6 satellite on May 20, 1981, while the visible image was obtained with a Meteor satellite on May 19, 1984. Similar conditions are shown to produce similar circulation patterns, consisting of an anticyclonic eddy and interrelated meridional and zonal jetlike or mushroomlike currents 150-250 km in extent. The possible mechanism for their formation is examined together with the conditions under which this eddy-jet combination is most probable. B.J.

A86-32677

SOME FEATURES OF SMALL-SCALE OCEAN EDDIES ACCORDING TO AN ANALYSIS OF SATELLITE IMAGES [O NEKOTORYKH OSOBENNOSTIAKH MELKOMASSHTABNYKH OKEANSKIKH VIKHREI /PO DANNYM ANALIZA SPUTNIKOVYKH IZOBRAZHENII/]

A. S. KAZMIN and N. P. KUZMINA (AN SSSR, Institut Okeanologii, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1986, p. 14-19. In Russian. refs

Salyut-6 and Landsat-1 images of several regions of the Gulf Stream and North Atlantic current are analyzed. The analysis yielded a more accurate spatial pattern of small-scale (5-30 km) eddies and improved their correlation and large-scale circulation features. B.J.

A86-32678

SALYUT-6 OBSERVATION OF COLOR AND BRIGHTNESS CONTRASTS CORRELATED WITH OCEAN-BOTTOM RELIEF [NABLIUDENIE S ORBITAL'NOI STANTSII 'SALIUT-6' TSVETOVYKH I IARKOSTNYKH KONTRASTOV, KORRELIROVANNYKH S REL'EFOM DNA OKEANA]

V. T. ISAKOV, V. V. KOVALENOK, A. I. LAZAREV, and T. A. DAMINOVA (Gosudarstvennyi Opticheskii Institut, Leningrad, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1986, p. 20-25. In Russian.

A86-32679

REMOTE SENSING AND MODELING OF THE DYNAMICS OF THE WESTERN PART OF THE BLACK SEA [DISTANTSIONNYE I MODEL'NYE ISSLEDOVANIIA DINAMIKI ZAPADNOI CHASTI CHERNOGO MORIA]

E. V. STANEV, L. I. MILENOVA, V. M. RUSENOV, and E. K. RUMENINA (Natsional'nyi Komitet po Issledovaniiu i Ispol'zovaniiu Kosmicheskogo Prostranstva, Sofia, Bulgaria) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1986, p. 26-31. In Russian. refs

The dynamics of the western part of the Black Sea was investigated on the basis of Salyut-Soyuz MSS data and numerical modeling. It is shown that the propagation of Danube waters, frontal zones, the meandering of the main stream, and the formation of off-shore rings in the western Black Sea could be recognized on the space images. The remote-sensing and simulation data are compared for features of different scales. B.J.

A86-32683

DETERMINATION OF SEA SPECTRAL REFLECTANCE FROM AIRBORNE MEASUREMENTS [OPREDELENIE KOEFFITSIENTA SPEKTRAL'NOI IARKOSTI MORIA PO IZMERENIIAM S AVIANOSITELIA]

A. P. VASILKOV, O. A. ERSHOV, and A. I. SUDBIN (AN SSSR, Institut Okeanologii, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1986, p. 63-70. In Russian. refs

Upward radiance spectra measured by helicopter at 2-5 km over Black Sea coastal areas are analyzed. The data were used to retrieve spectra at sea level; and the spectra were corrected for atmospheric effects using a modified Gordon algorithm and concurrent measurements of atmospheric spectral transparence. The correction method made it possible to retrieve the sea spectral reflectance in the 400-700 nm range with a maximum absolute error of about 0.01 for measurement altitudes up to 5 km. The retrieval accuracy was checked by comparing the spectra obtained with those measured at 100 m. B.J.

A86-33104*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

REDUCTION OF WEATHER EFFECTS IN THE CALCULATION OF SEA ICE CONCENTRATION FROM MICROWAVE RADIANCES

P. GLOERSEN and D. J. CAVALIER (NASA, Goddard Space Flight Center, Greenbelt, MD) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, March 15, 1986, p. 3913-3919. NASA-supported research. refs

A technique is presented which improves existing methods of calculating sea ice concentrations from microwave radiances by reducing weather-related effects over open ocean areas and in the vicinity of marginal sea ice zones. Winds, atmospheric water vapor, cloud liquid water, and rain increase the microwave emission over these regions and thus result in erroneous values of computed sea ice concentration. The method described is based on the microwave spectral properties of sea ice and ice-free ocean and utilizes ratios of the polarized radiances at the 0.81-cm (37 GHz) and 1.7-cm (18 GHz) wavelengths. Following a discussion of the physical basis for this technique, examples are provided which demonstrate its utility. While the technique was developed for use with the Nimbus 7 scanning multichannel microwave radiometer data, it is applicable also to data from other microwave radiometers operating in a similar wavelength range. Author

A86-33105* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

WEDDELL-SCOTIA SEA MARGINAL ICE ZONE OBSERVATIONS FROM SPACE, OCTOBER 1984

F. D. CARSEY, B. HOLT (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), S. MARTIN, D. A. ROTHROCK (Washington, University, Seattle), L. MCNUTT (Radarsat, Ottawa, Canada) et al. Journal of Geophysical Research (ISSN 0148-0227), vol. 91, March 15, 1986, p. 3920-3924. NASA-supported research. refs

Imagery from the Shuttle imaging radar-B experiment as well as other satellite and meteorological data are examined to learn more about the open sea ice margin of the Weddell-Scotia Seas region. At the ice edge, the ice forms into bandlike aggregates of small ice floes similar to those observed in the Bering Sea. The radar backscatter characteristics of these bands suggest that their upper surface is wet. Further into the pack, the radar imagery shows a transition to large floes. In the open sea, large icebergs and long surface gravity waves are discernable in the radar images. Author

A86-33120

EVOLUTION OF THE NET SURFACE SHORTWAVE RADIATION OVER THE INDIAN OCEAN DURING SUMMER MONEX (1979) - A SATELLITE DESCRIPTION

C. GAUTIER (California, University, La Jolla) Monthly Weather Review (ISSN 0027-0644), vol. 114, March 1986, p. 525-533. NASA-supported research. refs
(Contract NSF ATM-82-05817; NSF OCE-82-14791)

The evolution of the net shortwave (NSW) radiation fields during the monsoon of 1979 was analyzed, using geostationary satellite data, collected before, during, and after the monsoon onset. It is seen, from the time sequence of NSW fields, that during the preonset phase the characteristics of the NSW field are dominated by a strong maximum in the entire Arabian Sea and by a strong minimum in the central and eastern equatorial Indian Ocean, the minimum being associated with the intense convective activity occurring in that region. As the season evolves, the minima of NSW associated with the large scale convective activity propagate westward in the equatorial ocean. During the monsoon onset, there occurs an explosive onset of the convection activity in the Arabian Sea: the maximum has retreated towards the Somalia coast, and most of the sea then experiences a strong minimum of NSW associated with the intense precipitation occurring along the southwestern coast of the Indian subcontinent. I.S.

A86-33315

STRUCTURAL FEATURES OF THE EASTERLY JET STREAM ACCORDING TO SATELLITE DATA [OB OSOBENNOSTIAKH STRUKTURY VOSTOCHNOGO STRUINOGO TECHENIIA PO DANNYM ISZ]

T. KH. GEOKHLANIAN IN: Aspects of the processing and interpretation of measurement data from meteorological satellites . Leningrad, Gidrometeoizdat, 1985, p. 19-26. In Russian. refs

Several features of the cloud structure of the easterly jet stream are examined on the basis of a combined analysis of cloud photographs taken by the Meteor and NOAA satellites, and aerosynoptic data. It is noted that these features can serve as the basis of an analysis of weather in the tropical zone of the Indian Ocean. B.J.

A86-33320

ESTIMATION OF THE ACCURACY OF THE REMOTE DETERMINATION OF OCEAN SURFACE TEMPERATURE ON THE BASIS OF SATELLITE MEASUREMENTS OF OUTGOING THERMAL RADIATION IN THE 10.5-12.5 MICRON RANGE [OTSENKI TOCHNOSTI DISTANTSIONNOGO OPREDELENIIA TEMPERATURY POVERKHNOSTI OKEANA PO DANNYM SPUTNIKOVYKH IZMERENII UKHODIASHCHEGO TEPLOVOGO IZLUCHENIIA V DIAPAZONE 10,5-12,5 MKM]

V. M. SUTOVSKII, A. B. USPENSKII, and V. E. TRETIAKOV IN: Aspects of the processing and interpretation of measurement data from meteorological satellites . Leningrad, Gidrometeoizdat, 1985, p. 66-79. In Russian. refs

A86-33392

OBSERVATION OF INTERNAL WAVES AND SEISMIC WAVES IN THE SICILIAN CHANNEL

P. TRIVERO (Torino, Universita; CNR, Istituto di Cosmogeofisica, Turin, Italy) Nuovo Cimento, Lettere, Serie 2, vol. 44, Dec. 16, 1985, p. 658-664. refs

Internal and seismic waves in the Sicilian Channel are studied. The structural features of the internal waves observed in synthetic aperture radar images are examined; internal waves propagating in a circle about 60 km in diameter and about 1 km apart, radar signatures, and volcanic activity are detected. Analysis of the six months of seismographic data reveals low frequency oscillations occurring in groups of decreasing amplitude at 1 hour intervals, which are preceded by intensified signals in the seismograph readings, and a correlation between the occurrence of earthquakes and the shape of the oscillations is observed. I.F.

A86-33481

SATELLITE OCEANIC REMOTE SENSING

B. SALTZMAN, ED. (Yale University, New Haven, CT) Orlando, FL, Academic Press, Inc. , 1985, 525 p. For individual items see A86-33482 to A86-33490.

Oceanic remote sensing by several NASA sponsored satellite systems is described, and the results of these measurements are discussed. Papers are presented on the Seasat, Nimbus-7, and TIROS-N observations; analysis and interpretation of altimeter sea echo; oceanic surface winds; surface and internal ocean wave observations; and microwave wind and rain observations in severe tropical and midlatitude marine storms. Consideration is given to sea surface temperature determinations, ocean color measurements, observations of the polar regions from satellites using active and passive microwave techniques, precipitation in tropical cyclones, and living marine resources applications. Additional papers provide details of the remote sensors involved in these oceanic studies, details of the Seasat validation program, and a summary of the data availability. I.S.

A86-33482

THE 1978 OCEANIC TRILOGY - SEASAT, NIMBUS-7, AND TIROS-N

J. W. SHERMAN, III (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) IN: Satellite oceanic remote sensing . Orlando, FL, Academic Press, Inc., 1985, p. 11-60. refs

The sensors aboard NASA's Seasat, Nimbus-7, and TIROS-N satellites are described. These include the Seasat-A Scatterometer System (SASS), a radar altimeter, a SAR, the Scanning Multichannel Microwave Radiometer, the Visible and Infrared Radiometer, and the Coastal Zone Color Scanner. Results obtained on ice dynamics, ocean color, sea surface temperature, atmospheric water, wind characteristics, sea current characteristics, and eddy structures, are summarized. I.S.

A86-33483

ANALYSIS AND INTERPRETATION OF ALTIMETER SEA ECHO

D. E. BARRICK (Ocean Surface Research, Boulder, CO) and B. J. LIPA (Ocean Surface Research, Woodside, CA) IN: Satellite oceanic remote sensing . Orlando, FL, Academic Press, Inc., 1985, p. 61-100. refs

Attention is given to Barrick's (1972) mathematical model describing the altimetric echo waveform, using physical optics to represent the scatter from the rough surface. A convolutional form of this model is presented which expresses the sea surface wave-height probability density function. Models are developed to study various factors which bias or distort the altimeter echo, such as antenna errors and rain biases, and the Seasat altimeter data are used to test their application. I.S.

A86-33484

OCEANIC SURFACE WINDS

D. B. ROSS (NOAA, Atlantic Oceanographic and Meteorological Laboratory, Miami, FL), V. J. CARDONE (Oceanweather, Inc., White Plains, NY), J. OVERLAND (NOAA, Pacific Marine Environmental Laboratories, Seattle, WA), R. D. MCPHERSON (NOAA, National Meteorological Center, Washington, DC), and W. J. PIERSON, JR. (City College, New York) IN: Satellite oceanic remote sensing . Orlando, FL, Academic Press, Inc., 1985, p. 101-140. refs

The mechanism of radar backscatter, which prvides a foundation for wind measurements by the Seasat-A Scatterometer System (SASS) is examined. Development of a model relating the SASS data to surface wind speed, which accounts for changes of the marine wind field and the effects of the surface roughness and thermodynamic factors, is discussed. The effect produced by including the satellite data into the standard data base on atmospheric circulation is evaluated using an experiment in which global SASS data were compared with the wind data obtained without SASS (NOSASS). In the Northern Hemisphere, there is little difference between SASS and NOSASS analysis, suggesting that SASS winds are at least as useful as ship winds, buoy reports, and low level, cloud-tracked winds. In the Southern Hemisphere, differences in wind and height analyses were quite large. I.S.

A86-33485* National Oceanic and Atmospheric Administration, Boulder, Colo.

SURFACE AND INTERNAL OCEAN WAVE OBSERVATIONS

C. L. RUFENACH, L. S. FEDOR (NOAA, Wave Propagation Laboratory, Boulder, CO), J. R. APEL (Johns Hopkins University, Laurel, MD), and F. I. GONZALEZ (NOAA, Pacific Marine Environmental Laboratories, Seattle, WA) IN: Satellite oceanic remote sensing . Orlando, FL, Academic Press, Inc., 1985, p. 141-196. NOAA-supported research. refs
(Contract NASA ORDER W-15084)

The physical characteristics of the ocean surface waves are discussed, together with the prinicples behind altimetry measurements of the wave height and SAR measurements of surface wave direction and length. In addition, theoretical aspects of oceanic internal gravity waves are presented, and the measurements of oceanic internal wave fields, using the 'surface signatures' accompanying the underlying oscillations, are described. Results of the surface wave measurements obtained by the Seasat altimeter and SAR are presented along with inferred internal wave results obtained by SAR. I.S.

A86-33486* National Oceanic and Atmospheric Administration, Miami, Fla.

SEASAT MICROWAVE WIND AND RAIN OBSERVATIONS IN SEVERE TROPICAL AND MIDLATITUDE MARINE STORMS

P. G. BLACK, J. D. HAWKINS (NOAA, Atlantic Oceangraphic and Meteorological Laboratory, Miami, FL), R. C. GENTRY (Clemson University, SC), and V. J. CARDONE (Oceanweather, Inc., White Plains, NY) IN: Satellite oceanic remote sensing . Orlando, FL, Academic Press, Inc., 1985, p. 197-277. NOAA-NASA-sponsored research. refs

Initial results of studies concerning Seasat measurements in and around tropical and severe midlatitude cyclones over the open ocean are presented, together with an assessment of their accuracy and usefulness. Complementary measurements of surface wind speed and direction, rainfall rate, and the sea surface temperature obtained with the Seasat-A Satellite Scatterometer (SASS), the Scanning Multichannel Microwave Radiometer (SMMR), and the Seasat SAR are analyzed. The Seasat data for the Hurricanes Fico, Ella, and Greta and the QE II storm are compared with data obtained from aircraft, buoys, and ships. It is shown that the SASS-derived wind speeds are accurate to within 10 percent, and the directions are accurate to within 20 percent. In general, the SASS estimates tend to measure light winds too high and intense winds too low. The errors of the SMMR-derived measurements of the winds in hurricanes tend to be higher than those of the SASS-derived measurements. I.S.

A86-33487

SEA SURFACE TEMPERATURE DETERMINATIONS

J. C. ALISHOUSE and E. P. MCCLAIN (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) IN: Satellite oceanic remote sensing . Orlando, FL, Academic Press, Inc., 1985, p. 279-296. refs

Sea surface temperature (SST) determinations by the use of microwave and infrared sensors aboard Seasat, the Scanning Multichannel Microwave Radiometer (SMMR) and the Advanced Very High Resolution Radiometer (AVHRR), respectively, are discussed. The SMMR data have been screened to avoid rain, sun glint, and land effects, while the AVHRR data have been screened for clouds and sun glint. Comparison of the SMMR data with surface observations on both a point-by-point and a monthly grid basis have shown much better agreement between the averaged and the gridded values than in the case of point-by-point comparison. The point-by-point comparison between the AVHRR-derived SST's and surface observations are better than in the case of the SMMR, possibly because of the much smaller field of view. I.S.

A86-33488* Miami Univ., Fla.

OCEAN COLOR MEASUREMENTS

H. R. GORDON (Miami, University, Coral Gables, FL), R. W. AUSTIN (California, University, Scripps Institution of Oceanography, La Jolla), D. K. CLARK, W. A. HOVIS (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC), and C. S. YENTSCH (Bigelow Laboratory for Ocean Sciences, West Boothbay Harbor, ME) IN: Satellite oceanic remote sensing . Orlando, FL, Academic Press, Inc., 1985, p. 297-333. refs
(Contract NAS5-22963; NAS5-26247; NAS5-22948;
N00014-78-C-0566; NAGW-273; NOAA-NA-79SA00741;
NOAA-NA-80AAD00007)

Ocean color observations by the Coastal Zone color scanner (CZCS) aboard the Nimbus-7 satellite are discussed, together with the factors contributing to the 'apparent' color of the ocean. The CZCS optical systems and the tecniques for extraction of the phytoplankton pigment concentration and the diffuse attenuation coefficient K from the 'apparent' water color are described in detail. Special consideration is given to the use of biooptical algorithms and the development of the K algorithm for the CZCS imagery. It is shown that under typical atmospheric conditions, the pigment concentration can be extracted from the satellite imagery to within + or - 30 percent over concentration ranges from 0 to 5 mg/cu m for the Morel case 1 water (Morel and Prieur, 1977), to which the oceanic waters belong as a rule. I.S.

A86-33489* Massachusetts Univ., Amherst.

OBSERVATIONS OF THE POLAR REGIONS FROM SATELLITES USING ACTIVE AND PASSIVE MICROWAVE TECHNIQUES

C. T. SWIFT (Massachusetts, University, Amherst), D. J. CAVALIERI (USGS, Tacoma, WA), P. GLOERSEN, H. J. ZWALLY, N. M. MOGNARD (NASA, Goddard Space Flight Center, Greenbelt, MD) et al. IN: Satellite oceanic remote sensing . Orlando, FL, Academic Press, Inc., 1985, p. 335-392. refs

Observations of the ocean ice, ice sheets, ice edges, and ocean waves in the Antarctic, performed by the Seasat and Nimbus-7 satellites are described. Specific features of the Seasat altimeter, the SAR, the Seasat-A Scatterometer System, and the Scanning Multichannel Microwave Radiometer (SMMR) are discussed, together with the advantages and limitations of each instrument as applied to the study of ice dynamics. The Nimbus-7 SMMR algorithm for calculating sea-ice concentrations is presented. In addition, the Seasat altimeter-derived data on wind speed and wave heights in the Southern Ocean, and on the ice sheets of the Antarctica and Greenland were evaluated. I.S.

A86-33490

PRECIPITATION IN TROPICAL CYCLONES

C. G. GRIFFITH and L. S. FEDOR (NOAA, Environmental Research Laboratories, Boulder, CO) IN: Satellite oceanic remote sensing . Orlando, FL, Academic Press, Inc., 1985, p. 393-417. refs

Using the Griffith-Woodley (Griffith et al., 1978) technique, rain rates were derived from the Seasat Visible and Infrared Radiometer (VIRR)-IR data for selcted passes over three 1978 Pacific tropical storms: Fico, Agnes, and Carmen. The Griffith-Woodley technique is described in detail, and its limitations are discussed. The VIRR-derived rain rates, besides being useful for assessing storm rainfall prior to landfall, can also be used to correct for attenuation in microwave channels sensitive to rainfall, such as the altimeter and scatterometer. I.S.

A86-33514

MULTIFREQUENCY OBSERVATIONS OF BRIGHTNESS TEMPERATURE OF ARTIFICIAL NEW AND YOUNG SEA ICE

T. C. GRENFELL (Washington, University, Seattle) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 92-98. refs

An effective technique for isolating the influence of individual physical properties of sea ice on microwave emission is to study a horizontally homogeneous ice sheet whose thermal history and physical characteristics are closely monitored. This has been undertaken by a study encompassing radiometric, dielectric and scatterometric properties, whose preliminary results are presently reported. The major variations observed were associated with ice growth to about 50 mm, as well as with subsequent changes in the state of the state of the surface associated with roughness and the distribution of brine. The effects of snow cover were significant, but smaller than modifications in surface roughness. O.C.

A86-33529* Illinois Univ., Urbana.

REMOTE SENSING OF ATMOSPHERIC PRESSURE AND SEA STATE USING LASER ALTIMETERS

C. S. GARDNER (Illinois, University, Urbana) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 199-206. refs
(Contract NSG-5049)

Short-pulse multicolor laser ranging systems are currently being developed for satellite ranging applications. These systems use Q-switched pulsed lasers and streak-tube cameras to provide timing accuracies approaching a few picoseconds. Satellite laser ranging systems have been used to evaluate many important geophysical phenomena such as fault motion, polar motion and solid earth tides, by measuring the orbital perturbations of retroreflector equipped satellites. Some existing operational systems provide range resolution approaching a few millimeters. There is currently considerable interest in adapting these highly accurate systems for use as airborne and satellite based altimeters. Potential applications include the measurement of sea state, ground topography and atmospheric pressure. This paper reviews recent progress in the development of multicolor laser altimeters for use in monitoring sea state and atmospheric pressure. Author

A86-33532* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LIDAR OBSERVATIONS OF THE PLANETARY BOUNDARY LAYER

S. H. MELFI, J. D. SPINHIRNE, and S. P. PALM (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 218-222. refs

The application of an airborne downward-looking lidar to the study of organized cellular convection in the planetary boundary layer (PBL) over the ocean is described. The lidar consisted of a frequency doubled Nd-YAG 530 mm-wavelength laser whose axis was aligned colinearly with the optical axis of an all-reflecting 40 mm-diameter Newtonian telescope. The airborne lidar provided a unique observation of both microscale and mesoscale variations of the PBL top. The lidar data, presented as constant backscatter isopleth soundings, provide a visual indication of the presence of vertically organized convection cells. Comparisons of the lidar-derived PBL structure with both a conceptual model of the PBL and laboratory simulations of Deardorf et al. (1980) of a developing convective PBL showed that the observations are consistent with a model of mixing in the PBL, which involves a field of organized updrafts separated by downdrafts. I.S.

A86-33560* Washington Univ., Seattle.

EXTRACTING SEA ICE DATA FROM SATELLITE SAR IMAGERY

M. FILY and D. A. ROTHROCK (Washington, University, Seattle) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 432-437. NASA-Navy-supported research. refs

With the prospect operational satellite SAR's by the end of the decade, there is a clear need to develop automated algorithms for the extraction of geophysical data about sea ice from high resolution radar imagery. To this end, techniques were developed for distinguishing ice from open water and for resolving the details of deformation within areas 100 km square imaged by SEASAT SAR. The classification of ice and open water is based on the creation of two bands of lower resolution image data: local average brightness, and the local variance of brightness. In the space of these two variables, ice and open water are separated into two distinct clusters. The deformation is found on a 3.4 km mesh by local cross-correlations of the brightness. Comparison with manually determined deformation shows room for improvement in regions of high deformation by using smaller areas for cross-correlation. Th concentration and deformation data are used together to determine localized regions of the scene where open water is produced or lost. Author

A86-33561

SAR REMOTE SENSING DURING MIZEX 84

R. A. SHUCHMAN and B. A. BURNS (Michigan, Environmental Research Institute, Ann Arbor) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 439-443.
(Contract N00014-81-C-0295; N00014-83-C-0404)

During the summer Marginal Ice Zone Experiment (MIZEX) of 1984, extensive mosaic coverage of the experiment area was obtained by the CV-580 Synthetic Aperture Radar (SAR) system over a period of 10 days. By virtue of the SAR's imaging capabilities, such as all-weather imaging, relatively high resolution, and large dynamic range of backscatter from SAR ice and open ocean, information on important MIZ parameters can be derived from the SAR data. Information on ice edge location and location of ice-edge eddies, for example, can be obtained directly from examination of the imagery as can detection of ocean fronts and internal waves. With machine-assisted manual image analysis, estimates of ice concentration, floe size distributions, and ice field motion can also be derived. Full digital analysis, however, is required to obtain gravity wave spectral information and backscatter statistics for ice type discrimination and automated ice concentration algorithms. Author

A86-33562* National Oceanic and Atmospheric Administration, Boulder, Colo.

MEASUREMENT OF SEA ICE BACKSCATTER CHARACTERISTICS AT 36 GHZ USING THE SURFACE CONTOUR RADAR

L. S. FEDOR (NOAA, Wave Propagation Laboratory, Boulder, CO) and E. J. WALSH (NASA, Wallops Flight Center, Wallops Island, VA) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 446-451.

Scattering studies of sea ice off the coast of Greenland were performed in January 1984 using the 36-GHz Surface Contour Radar (SCR) aboard the NASA P-3 aircraft. An oscillating mirror scans an actual half-power width of 0.96 degrees laterally to measure the surface at 51 evenly spaced points. By banking the aircraft, real-time topographical mapping and relative backscattered power are obtained at incidence angles between 0 and 30 degrees off-nadar, achieving at 175 m altitude a 2.9 by 4.4 m spatial resolution at nadir. With an aircraft ground speed of 100 m/s, 5-m successive scan line spacing and 1.8-m cross-track direction spacing is provided. By circling the aircraft in the 15 degree bank, the azimuthal anisotropy of the scattering is investigated along with the incidence angle dependence. R.R.

A86-33591* National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.

DESIGN AND BENEFITS OF A MULTIBEAM EARTH OBSERVING RADAR

C. L. PARSONS, E. J. WALSH (NASA, Wallops Flight Center, Wallops Island, VA), and F. B. BECK (NASA, Langley Research Center, Hampton, VA) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 650-656. refs

The oceanographic rationale is described for continuing to advance the state of the art in satellite radar altimetry, and the expected capabilities of a multibeam Earth Observing Radar are noted. At the end of this decade, there is the possibility that altimeters may be in orbit aboard the American TOPEX, the ESA ERS-1, and the French SPOT satellites at the same time. The TOPEX version will be the most precise altimeter yet built. Global ocean circulation will be measured by using TOPEX to monitor the elevation changes across the ocean basins due to oceanic currents. It will then be possible to monitor the 'mean' circulation patterns in the oceans. The multiple beams of EOR might be used to measure the curvature of the topographic surface. The use of curvature is especially beneficial because it is directly related to ocean circulation, which is a function only of the Laplacian of the topographic height field in a given area. With the EOR, that height field will be known and ocean circulation can be immediately computed. D.H.

A86-33601* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

A MEDIAN FILTER APPROACH FOR CORRECTING ERRORS IN A VECTOR FIELD

H. SCHULTZ (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 724-728.

Techniques are presented for detecting and correcting errors in a vector field. These methods employ median filters which are frequently used in image processing to enhance edges and remove noise. A detailed example is given for wind field maps produced by a spaceborne scatterometer. The error detection and replacement algorithm was tested with simulation data from the NASA Scatterometer (NSCAT) project. Author

A86-33602

THE SPATIAL EVOLUTION OF SAR DERIVED WAVE SPECTRA IN THE VICINITY OF HURRICANE IVA

F. M. MONALDO, D. E. IRVINE (Johns Hopkins University, Laurel, MD), and F. I. GONZALEZ (NOAA, Pacific Marine Environmental Laboratory, Seattle, WA) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 731-736. refs

A swath of Seasat SAR imagery 1200 km long was used to generate a spatial series of SAR ocean image spectra in the vicinity of Hurricane IVA. These spectra were corrected for an instrument transfer function. By using a much longer image strip than previous investigators, it is possible to explain the evolution of SAR measured spectral parameters, dominate wavelength and propagation direction, in terms of simple kinematic parameters of the moving hurricane. Author

A86-33607

THE SIR-B EXTREME WAVES EXPERIMENT IN THE SOUTHERN OCEANS

R. C. BEAL (Johns Hopkins University, Laurel, MD) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 787-791. refs

An account is given of the October 1984 SIR-B Extreme Waves Experiment off the west coast of southern Chile and in the region of the Agulhas Current south and east of South Africa. The experiment was designed to overcome many of the limitations encountered in Seasat by collecting simultaneous and independent estimates of the directional wave spectra from aircraft to verify and calibrate the SAR measurements over a variety of incidence angles and sea states. For the SIR-B reflight, scheduled for March 1987, the intent is to repeat the Chile experiment just to the east and north of St. Johns, Newfoundland where North Atlantic storms are notorious for producing high waves. D.H.

A86-33608

WAVES PREDICTED BY THE GLOBAL SPECTRAL OCEAN WAVE MODEL OFF THE WEST COAST OF CHILE DURING THE SIR-B MISSION

L. F. ZAMBRESKY (U.S. Navy, Fleet Numerical Oceanography Center, Monterey, CA) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 792-797.

The verification of the GSOWM (Global Spectral Ocean Wave Model) of the Fleet Numerical Oceanography Center in the Southern Hemisphere in October 1984 is described. The primary output of GSOWM is directional wave spectra with a resolution of 15 frequencies and 24 directions at every point on a 2.5 degree latitude/longitude grid. From October 8 through October 12, 1984, SIR-B observed directional wave spectra of the southwestern tip of Chile from the Space Shuttle. Two airborne scanning radars made nearly simultaneous measurements. A wave model without any direct initialization through wave observations can predict waves with a reasonable degree of skill. The next step toward improving wave modeling would be to incorporate near real-time wave observations; a spaceborne synthetic aperture radar is one of the few viable instruments for providing the quasi-synoptic observations of directional wave spectra required by GSOWM. D.H.

A86-33609* National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.

SPECTRAL MEASUREMENTS IN SUPPORT OF SIR-B USING THE SURFACE CONTOUR RADAR

E. J. WALSH, D. W. HANCOCK, III, D. E. HINES (NASA, Wallops Flight Center, Wallops Island, VA), R. N. SWIFT, and J. F. SCOTT (EG & G Washington Analytical Services Center, Inc., Pocomoke City, MD) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 798-803. refs

The use of the Surface Contour Radar (SCR) from an aircraft to obtain spectral information on the seas off the tip of South America, in support of the SIR-B experiment in October 1984, is reported. The SCR is a computer-controlled 36-GHz radar that measures sea surface directional wave spectra and produces a real-time topographical map of the surface below the aircraft. Ground tracks and polar plots of the data obtained are illustrated. D.H.

A86-33611* Environmental Research Inst. of Michigan, Ann Arbor.

SIMULATIONS OF SAR WAVE SPECTRA USING HIGH SPECTRAL RESOLUTION ESTIMATES FROM THE SCR AND ROWS INSTRUMENTS

D. LYZENGA (Michigan, Environmental Research Institute, Ann Arbor) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 812-817. NASA-supported research. (Contract N00014-81-C-0692)

A numerical model for predicting the synthetic aperture radar (SAR) image of a moving ocean surface is described, and results are presented for two SIR-B data sets collected off the coast of Chile. Wave height spectra measured by the NASA radar ocean wave spectrometer (ROWS) and surface contour radar (SCR) were used as inputs to this model, and results are compared with actual SIR-B image spectra from orbits 91 and 106. Author

A86-33612

DIRECTIONAL OCEAN WAVE SPECTRA OBTAINED FROM THE SHUTTLE IMAGING RADAR OFF THE COAST OF CHILE

F. M. MONALDO and D. G. TILLEY (Johns Hopkins University, Laurel, MD) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 818-822. refs

During the Shuttle Imaging Radar Mission (SIR-B) in October 1984, synthetic aperture radar (SAR) ocean wave imagery was acquired coincident with independent measurements of the two-dimensional ocean wave spectrum made by instruments aboard a P-3 aircraft. Preliminary evaluation of SAR image spectra suggest a close correspondence between SAR image spectra and ocean surface slope-variance spectra. Author

A86-33619

RADAR SOUNDING OF ICE MASSES CONTAINING LIQUID WATER

S. M. HODGE (USGS; Puget Sound, University, Tacoma, WA) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 868-873. refs

When frequencies of 1-10 MHz are used, scattering from water-filled cavities found in temperate glaciers is sufficiently reduced that bottom returns are usually detectable. An impulse type of radar, with resistively-loaded antennas, is necessary for acceptable range resolution. Evidence from two independent radar studies, as well as from borehole drilling, suggests that the characteristic dimension of these cavities is of the order of 0.5-1.0 m. Significant potential exists for substantially improving overall system performance and for applying this remote sensing technique to studies of the internal structure and flow of polar ice sheets as well as temperate glaciers. Author

A86-33631

SATELLITE IMAGING OF COASTAL FLOW CIRCULATION IN RELATION TO NUMERICAL MODELLING

L. JONSSON (Lund, Universitet, Sweden) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 979-983.

Flow related problems have been investigated in the area of the coastal waters near southern Sweden, using numerical models and satellite imagery. Different kinds of approximation of flow behavior are examined - the shallow water approach and laterally integrated flow equations. Some of the applications are discussed especially with reference to assumptions made and the remotely sensed flow information. Satellite imaging has demonstrated its potential of providing large-scale synoptic flow information in the coastal waters off Scania, Sweden. Both temperature differences and suspended material were used as indicators. The findings have implications in several respects for numerical modeling. D.H.

A86-33632

APPLICABILITY OF ATMOSPHERIC CORRECTION ALGORITHM FOR CZCS DATA TO JAPANESE COASTAL AREA

H. FUKUSHIMA (Tokai University, Shimizu, Japan) and T. OGISHIMA (Hokkaido Regional Fisheries Research Laboratory, Kushiro, Japan) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 987-992. refs

Several concepts are discussed on which NASA's atmospheric correction algorithm strongly rely, based on the observed chlorophyll and irradiance data for Japanese coastal waters. The assumption that the water-leaving radiance at 670 nm is zero is tested against the observed data and the error due to the assumption is evaluated. It is shown that the error might be significant for areas with high sediment concentrations. The spectral relation of water-leaving radiance for various lambdas (the basis for the iterative procedure used when the radiance at 670 nm is not zero) is also discussed. The regularly observed chlorophyll concentration data from 1979-1983 around Japan are investigated to check the presence, extent, and location of the 'clear water' area which acts as an anchor point for atmospheric correction. Always finding such an area presents some difficulties, and this suggests the necessity for other algorithms that do not rely on this concept. D.H.

A86-33645

AN OVERVIEW OF THE SAR INTERNAL WAVE SIGNATURE EXPERIMENT

R. F. GASPAROVIC and J. R. APEL (Johns Hopkins University, Laurel, MD) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 1123-1128. Navy-supported research.

Activities during SARSEX Phase I (the synthetic aperture radar internal wave signature experiment) from August 27 to September 7, 1984 are summarized. SARSEX is a research program sponsored by the Office of Naval Research to investigate SAR imaging of oceanic internal wave surface effects. The experiment, conducted in the New York Bight south of Long Island was designed to yield calibrated SAR images of internal waves with coincident sea truth data to provide quantitative tests of model predictions for internal wave signatures. Oceanographic measurements were made from two research vessels. Four current meter moorings were implanted to measure internal wave currents. Dual frequency (X-band and L-band) SAR imagery was obtained from a CV-580 aircraft; another CV-580 aircraft flew a laser scatterometer and a third aircraft was used for visual observation of the internal wave surface features. A large body of data on the hydrodynamic properties and electromagnetic signatures of continental shelf internal waves was obtained under a variety of wind, surface wave, and radar illumination conditions. D.H.

A86-33646

SAR-OBSERVED INTERNAL WAVE SIGNATURES FROM SARSEX - INITIAL OBSERVATIONS

E. S. KASISCHKE, R. A. SHUCHMAN, and D. R. LYZENGA (Michigan, Environmental Research Institute, Ann Arbor) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 1129-1134.

(Contract N00014-81-C-0692)

The aircraft SAR data set collected during the 1984 SARSEX experiment is summarized. Digitally-recorded and processed imagery (X- and L-band), collected on August 31, 1984, is presented, along with calibrated radar cross-section scans showing internal wave surface patterns. These scans reveal a distinct difference for the signatures between X- and L-bands, with the L-band signatures having a greater peak-to-background modulation. Also, the scans reveal that the SAR images range-traveling waves more distinctly than azimuth-traveling waves. Author

A86-33647

SAR OBSERVED INTERNAL WAVE SIGNATURES FROM SARSEX-COMPARISONS WITH SAR IMAGING MODELS

R. A. SHUCHMAN, E. S. KASISCHKE, D. R. LYZENGA (Michigan, Environmental Research Institute, Ann Arbor), and D. R. THOMPSON (Johns Hopkins University, Laurel, MD) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 1153-1159. refs

(Contract N00014-81-C-0692; N00024-83-C-5301)

This paper discusses comparisons between actual and model predicted SAR intensities from internal waves collected during the 1984 SARSEX experiment. A SAR ocean surface imaging model based upon the spectral perturbation of Bragg scatterers is described. Results from this model are compared with the SAR observations. At L-band, the model predictions compare favorably with the SAR observations for range-traveling internal waves. The model present predicts no surface signature for any X-band cases and for L-band azimuth-traveling waves, whereas the SAR clearly shows signatures for these cases. Other possible imaging mechanisms are suggested. Author

A86-34488

OPTIMAL DISPOSITION OF SATELLITE-TRACKED DRIFTING BUOYS IN THE SOUTH ATLANTIC [OB OPTIMAL'NOM RAZMESHCHENII V IUZHNOI ATLANTIKE DREIFUIUSHCHIKH BUEV, OTSLEZHIVAEMYKH SO SPUTNIKOV]

A. F. TRESHNIKOV, V. V. GURETSKII, A. I. DANILOV, V. N. EREMEEV, L. M. IVANOV (Arkticheskii i Antarkticheskii Nauchno-Issledovatel'skii Institut, Leningrad, USSR) et al. Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 287, no. 2, 1986, p. 430-434. In Russian. refs

A86-34743

ESTIMATION OF SEA-SURFACE TEMPERATURE FROM AVHRR DATA COMMENTS ON THE PAPER BY SINGH ET AL. (1985)

J. R. EYRE (Oxford University, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, March 1986, p. 465-469. refs

The method proposed by Singh et al. (1985) for estimating sea-surface temperature using one channel of the Advanced Very High Resolution Radiometer is shown to be, in its optimum form, mathematically equivalent to a simple linear regression method. The relationship between single-channel and split-window methods and the reasons for the superiority of the latter over the former are discussed. Author

A86-34764
INVESTIGATION OF THE CONTENT OF TRACE ELEMENTS IN SEA AEROSOLS AND THE SURFACE MICROLAYER OFF SEA WATER [ISSLEDOVANIE SODERZHANIIA MIKROELEMENTOV V MORSKIKH AEROZOLIAKH I POVERKHNOSTNONI MIKROSLOE MORSKOI VPDY]
V. D. KORZH (AN SSSR, Institut Okeanologii, Moscow, USSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 286, no. 6, 1986, p. 1348-1351. In Russian. refs

A86-35278#
ACCURACY ESTIMATE OF GEOID AND OCEAN TOPOGRAPHY RECOVERED JOINTLY FROM SATELLITE ALTIMETRY
C. A. WAGNER (NOAA, National Geodetic Survey, Rockville, MD) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Jan. 10, 1986, p. 453-461. refs

Joint determination of the geoid and permanent dynamic sea topography is demonstrated by simulation from direct use of satellite altimetry. The separation is feasible because of the disparities between the error spectra of the geoid and its unique perturbative effects as seen on the orbit. The solution for the components of the permanent topography from 14 cm Seasat altimetry promises to yield accurate results down to half wavelengths of about 1000 km. Present discrimination of this surface from disjoint satellite altimeter results appears to be at a scale near 4000 km. The radial effects of uncertainties in the M2 ocean tide on the Seasat orbit and altimeter measurements will probably be only a minor contaminant of the solution. Author

A86-35531
INTENSITY MODULATION IN SAR IMAGES OF INTERNAL WAVES
D. R. THOMPSON and R. F. GASPAROVIC (Johns Hopkins University, Laurel, MD) Nature (ISSN 0028-0836), vol. 320, March 27, 1986, p. 345-348. Navy-sponsored research. refs

During the SAR Signature Experiment (SARSEX), conducted in 1984 in the New York Bight off the eastern coast of the United States, SAR images of the ocean surface and concurrent ground-truth measurements were collected in order to test quantitatively various imaging theories. These theories predict that the intensity modulations observed in SAR images of internal waves are produced by variations in the internal wave surface roughness induced by spatial variations in the internal wave surface current field. Analysis of the SARSEX data indicates that the imaging theories can explain the observed modulation for L-band SAR wavelengths, but underpredict by almost an order of magnitude the observed X-band modulation. This discrepancy is explained by hypothesizing a two-step mechanism in which the observed X-band modulation results from additional small-scale roughness produced by the strong perturbation of meter-scale surface waves by the internal wave current field. C.D.

A86-35545
SATELLITE OBSERVATIONS OF SEA SURFACE COOLING BY HURRICANES
L. STRAMMA, P. CORNILLON (Rhode Island, University, Narragansett), and J. F. PRICE (Woods Hole Oceanographic Institution, MA) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, April 15, 1986, p. 5031-5035. refs
(Contract N00014-81-C-0062; N00014-76-C-0197; NR PROJECT 083-165; NR PROJECT 083-400)

Sea surface cooling associated with 13 hurricanes in the western North Atlantic between September 1981 and December 1984 is examined, using satellite-derived sea surface temperature fields. Some surface cooling is observed in all cases; however, because of cloud cover and the fairly weak signal in some cases, pronounced cooling is seen along an extensive and continuous portion of the storm path for only three strong hurricanes. The persistence of cooling following the passage of a hurricane varies from a few days to at least 16 days. The amplitude of cooling is moderately well correlated with hurricane strength, and is as large as 3.5 C. When the hurricanes move rapidly, the maximum cooling occurs well to the right of the track (approximately 70 km), whereas for slowly moving hurricanes the maximum cooling occurs near or on the track. Because western North Atlantic hurricanes are often found in close proximity to high pressure systems, daytime satellite images must be made with some care because of diurnal warming. Author

A86-35550* Washington Univ., Seattle.
A SIMPLE, OBJECTIVE ANALYSIS SCHEME FOR SCATTEROMETER DATA
G. LEVY and R. A. BROWN (Washington, University, Seattle) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, April 15, 1986, p. 5153-5158. refs
(Contract NAGW-679)

A simple economical objective analysis scheme is devised and tested on real scatterometer data. It is designed to treat dense data such as those of the Seasat A Satellite Scatterometer (SASS) for individual or multiple passes, and preserves subsynoptic scale features. Errors are evaluated with the aid of sampling ('bootstrap') statistical methods. In addition, sensitivity tests have been performed which establish qualitative confidence in calculated fields of divergence and vorticity. The SASS wind algorithm could be improved; however, the data at this point are limited by instrument errors rather than analysis errors. The analysis error is typically negligible in comparison with the instrument error, but amounts to 30 percent of the instrument error in areas of strong wind shear. The scheme is very economical, and thus suitable for large volumes of dense data such as SASS data. Author

A86-35682
MICROWAVE RADIOMETRY FOR OIL POLLUTION MONITORING, MEASUREMENTS, AND SYSTEMS
N. SKOU (Danmarks Tekniske Hojskole, Lyngby, Denmark) (International Geoscience and Remote Sensing Symposium /IGARSS '84/: From Research toward Operational Use, Strasbourg, France, Aug. 27-30, 1984) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, May 1986, p. 360-367. refs

Work is presently carried out in Europe to change the status of the microwave radiometer, namely, to develop it from a research instrument to an operational instrument - especially for measuring oil pollution on the sea surface. The Technical University of Denmark (TUD), with its long experience in airborne microwave radiometry, is heavily involved in this process. The TUD multichannel imaging radiometer system has been flown in several large-scale oil-pollution experiments, the collected data have been analyzed, and they have revealed that care must be exercised to obtain accurate oil volume estimations. Computer simulations of the total measurement situation have shown how the observed difficulties come about and have indicated the countermeasures to apply. Based on the abovementioned exercises, optimum (and practical) systems are being developed. Author

A86-35683*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AIRCRAFT AND SATELLITE PASSIVE MICROWAVE OBSERVATIONS OF THE BERING SEA ICE COVER DURING MIZEX WEST
D. J. CAVALIERI, P. GLOERSEN, and T. T. WILHEIT, JR. (NASA, Goddard Space Flight Center, Greenbelt, MD) (International Geoscience and Remote Sensing Symposium /IGARSS '84/: From Research toward Operational Use, Strasbourg, France, Aug. 27-30, 1984) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, May 1986, p. 368-377. NASA-supported research. Previously announced in STAR as N84-33917. refs

Passive microwave measurements of the Bering Sea were made with the NASA CV-990 airborne laboratory during February. Microwave data were obtained with imaging and dual-polarized, fixed-beam radiometers in a range of frequencies from 10 to 183 GHz. The high resolution imagery at 92 GHz provides a particularly good description of the marginal ice zone delineating regions of open water, ice compactness, and ice-edge structure. Analysis of the fixed-beam data shows that spectral differences increase with a decrease in ice thickness. Polarization at 18 and 37 GHz distinguishes among new, young, and first-year ice types. ESA

A86-35666

RELATIVE VERTICAL POSITIONING USING GROUND-LEVEL TRANSPONDERS WITH THE ERS-1 ALTIMETER

R. J. POWELL (SERC, Rutherford Appleton Laboratory, Didcot, England) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, May 1986, p. 421-425.

The use of the ERS-1 satellite altimeter to measure the relative vertical position of land-based transponders and the ocean geoid on 2000-km-long segments of the satellite ground track is proposed. The procedures and equations for calculating delay measurements, evaluating their accuracy, and converting the delay data to range measurements are described. The usefulness of this technique is tested by obtaining measurements from aircraft using the RAL altimeter over ground-based corner reflectors; the experiment revealed the accuracy of the vertical positioning data and the validity of the predicted delay resolution. The vertical positioning data are applicable for altimeter calibration, measurements of sea-state bias effects, seismic and geodetic studies, and satellite orbit measurements. I.F.

A86-35860#

WIND DEPENDENCE OF L-BAND RADAR BACKSCATTER

A. SARKAR, L. BHADURI, and R. KUMAR (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India) Defence Science Journal (ISSN 0011-748X), vol. 35, Oct. 1985, p. 383-389.

Like other microwave frequency bands, L-band scattering coefficient measurements have shown a definite dependence on ocean surface wind speed (W). The relationship between the two depends on the observation angle of the radar. The satellite-borne L-band radars Seasat-SAR and SIR-A made observations at fixed incidence angles, while the just completed SIR-B mission has made observations at multiple incidence angles. The present work uses the theory of scattering from a composite surface and generates an analytic function of the relationship between the scattering coefficient and W for varying incidence angle at L-band by the method of empirical curve fitting. Author

A86-36048

SATELLITE THERMAL OBSERVATION OF OIL SLICKS ON THE PERSIAN GULF

I. ASANUMA, K. MUNEYAMA, Y. SASAKI (Japan Marine Science and Technology Center, Yokosuka), J. IISAKA (Canada Centre for Remote Sensing, Ottawa), Y. YASUDA (Chiba, University, Japan) et al. Remote Sensing of Environment (ISSN 0034-4257), vol. 19, April 1986, p. 171-186. refs

A possibility of oil slicks detection is discussed for oil slicks spread in the vicinity of the Nowruz oil fields in the Persian Gulf since March 1983 to July 1983 with considering an apparent thermal inertia. The apparent thermal was computed from continuous observations of sea surface temperature and albedo by the Advanced Very High Resolution Radiometer (AVHRR) on the NOAA-7 through day and night with 12 h interval. The apparent thermal inertia is defined as a function of a temperature difference between the daytime and the nighttime and an apparent albedo. Sea surface temperature used for computing the apparent thermal inertia was obtained through an atmospheric correction with an empirical equation which uses an energy difference between two thermal channels of the AVHRR. Although there was an ambiguity on a selection of same object on water body, the computed apparent thermal inertia showed the possibility of oil slicks detection from sea water. Author

A86-36096

GRAVITY ANOMALIES AND SEA SURFACE HEIGHTS DERIVED FROM A COMBINED GEOS 3/SEASAT ALTIMETER DATA SET

R. H. RAPP (Ohio State University, Columbus) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, April 10, 1986, p. 4867-4876. refs
(Contract F19628-82-K-0022)

The development of a set of gravity anomalies and sea surface height (SSH) on a 0.125 deg grid from altimeter data is described. The gravity anomalies and SSH set are estimated using Mortiz's (1980) method of least squares collocation. The point prediction tests performed to evaluate the accuracy of the gravity anomaly predictions are examined. The effect of sea surface topography on the predicted anomalies is studied. The predicted anomalies are compared with ship gravity data. The calculation of power spectra from the point predictions and of geoid undulation power between specified spherical harmonic degrees are discussed. I.F.

A86-36480

PROBABILISTIC MODELING OF FIELDS OF ATMOSPHERIC TURBULENCE AND SEA ROUGHNESS WITH REFERENCE TO THE STUDY OF COMPLEX SYSTEMS [VEROIATNOSTNOE MODELIROVANIE POLEI TURBULENTNOSTI ATMOSFERY I MORSKOGO VOLNENIIA PRI ISSLEDOVANII SLOZHNYKH SISTEM]

IU. I. PALAGIN, S. V. FEDOTOV, and A. S. SHALYGIN Radiotekhnika i Elektronika (ISSN 0033-8494), vol. 31, April 1986, p. 721-727. In Russian. refs

Simulation models of atmospheric turbulence and sea roughness are developed on the basis of parametric representations of random fields. The models do not exhibit errors in relation to the spectral-correlation characteristics, require a limited computation volume, and are convenient for implementation on both digital and analog processors. The present approach is applied to the statistical modeling of the motion-control system of a flight vehicle with a radar altimeter. Author

A86-36786

POSITION FIXING AFLOAT

A. E. INGHAM (Meeting on Location-Terrestrial Positioning and Geometric Correction of Imagery, University of Nottingham, England, May 23, 1984) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, April 1986, p. 541-546.

The utopian notion of position determination at sea is for an unlimited number of users to obtain an unambiguous, extremely accurate positioning facility, not only at the sea surface but also on the seabed or anywhere in between, 24 hours per day, continuously and in all weathers. This has traditionally implied such unattainable standards of technology that the notion has inspired little but cynical laughter. Now however, the notion has become reality for most of the practical situations encountered offshore. The question of how accurate a position should be can still evoke debate, of course, but only remote sensing and, perhaps, geodesy demand, on occasion, higher standards than are attainable by contemporary methods. This paper attempts to set in perspective the various methods employed to determine position offshore and to discuss in general terms the several approaches to the accuracy requirement. Author

A86-36954#

REMOTE SENSING WITH THE JINDALEE SKYWAVE RADAR

S. J. ANDERSON (Department of Defence, Electronics Research Laboratory, Adelaide, Australia) IN: Conference on the Ionosphere and Radio Wave Propagation, 3rd, Sydney, Australia, February 11-15, 1985, Proceedings . Darlinghurst, Australia, Ionospheric Prediction Service, 1985, 4 p. refs

An account is given of the use of the Jindalee skywave radar to produce a surface wind map that was transmitted over a facsimile link from near Alice Springs to the Bureau of Meteorology Regional Office in Darwin. The event, on February 7, 1985, marked the commencement of what may one day become a routine service - the provision of real-time wind and sea-state information extracted from skywave radar echoes. A concerted effort is under way to establish the viability and utility of employing the radar in this secondary (nonmilitary) role. Direct observables are: Bragg-resonant wave ratio; surface current, dominant wavenumber; swell frequency and direction; sea-state; nondirection spectrum; and directional spectrum. Wind direction and wind speed are inferred. Topics discussed include: the influence of the ionosphere; estimation of ocean surface parameters; validation of estimation procedures; and present and future radar capabilities. D.H.

A86-37013
ASSESSMENT AND TRENDS OF FLORIDA'S MARINE FISHERIES HABITAT AN INTEGRATION OF AERIAL PHOTOGRAPHY AND THEMATIC MAPPER IMAGERY
K. D. HADDAD and B. A. HARRIS (Florida Department of Natural Resources, St. Petersburg) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 130-138. refs

A86-37506
TECHNOLOGICAL IMPROVEMENTS TO NAVAL AVIATION WEATHER SUPPORT
H. E. NICHOLSON (U.S. Navy, Fleet Numerical Oceanography Center, Monterey, CA) IN: International Conference on the Aviation Weather System, 2nd, Montreal, Canada, June 19-21, 1985, Preprints . Boston, MA, American Meteorological Society, 1985, p. 321-324.

Problems unique to US Naval Aviation weather support, the system currently in use, and technological advances for the near future are presented in detail. The Fleet Numerical Oceanography Center (FNOC) in Monterey, California, is the center of the Naval support system as it now exists. Using a real-time data base and weather/ocean prediction models, the FNOC supplies the basic forecast guidance to US Naval forces around the world, noting various drawbacks. The NEDN (Naval Environmental Data Network) Oceanographic Data Distribution and Expansion System/ Satellite Data Processing Display System (NODDES/SPADS), to be installed in oceanography centers this year, is discussed. The NODDES side of the system will provide for communication, storage, manipulation and display of computer products and conventional data, while SPADS will do the same for satellite data. Other improvements to Naval Aviation weather support include the Aviation Support Display Station (ASDS) and the Optimum Path Aircraft Routing System (OPARS). ASDS will condense satellite and radar images, alphanumeric data and computer-generated weather charts into one unit, while OPARS will provide information on the most efficient flight routes. K.K.

A86-38648#
SEA LEVEL TIME SERIES IN THE EQUATORIAL PACIFIC FROM SATELLITE ALTIMETRY
L. MILLER, R. CHENEY, and D. MILBERT (NOAA, National Ocean Service, Rockville, MD) Geophysical Research Letters (ISSN 0094-8276), vol. 13, May 1986, p. 475-478. refs

Geosat, a Navy satellite launched in March 1985, will provide the first long-term, global altimeter data set. These observations will enable construction of monthly sea level maps of the equatorial Pacific, much like those presently derived from island tide gauges, but with greatly improved spatial resolution and coverage. During the first half of the Geosat mission, the satellite ground track will not repeat, requiring time series analyses to be based on altimetric height differences at crossover points. The 3-month Seasat data set was used in the equatorial Pacific to test the feasibility and accuracy of this procedure. Crossover differences were sorted into diamond-shaped areas with zonal and meridional dimensions of 200 and 400 km, respectively. The sea level time series in each of these areas was then determined using objective analysis. These computations show agreement within 5 cm between altimeter and island tide gauge observations on time scales greater than 1 month. Using this technique, it is proposed that monthly maps of sea level variability in the equatorial Pacific for the duration of the Geosat mission (approximately 3 years) can be constructed.

Author

A86-38718#
ERS-1 - OUR NEW WINDOW ON THE OCEANS FOR THE 1990S
D. T. LLEWELLYN-JONES (SERC, Rutherford Appleton Laboratory, Didcot, England) British Interplanetary Society, Journal (Space Science) (ISSN 0007-084X), vol. 39, May 1986, p. 228-234.

ESA's First Remote Sensing Satellite (ERS-1) due for launch in 1989 will monitor a carefully selected set of geophysical parameters in an effort to describe the state of the sea-surface. The payload instruments of ERS-1, how they make their measurements, and how the data will be dealt with, are described and discussed. The payload consists of three microwave radars: (1) a wind and wave scatterometer, (2) a synthetic aperture radar, and (3) a radar altimeter. These instruments are complemented by an Along Track Scanning Radiometer and a Precise Range and Range-Rate Experiment. The concept of fast delivery data products is an essential element of the ERS-1 system, meaning that the processed ERS-1 data will be distributed to designated points of contact within three hours of being obtained by the spacecraft. It is concluded that these measurements will lead to a better scientific understanding of ocean-atmosphere interactions; moreover, they will pave the way to the application of such data products to a large range of commercial activities. K.K.

N86-15969# Mound Lab., Miamisburg, Ohio.
OPERATIONAL METHODS FOR DATA INTERPOLATION
G. L. SILVER 1 Aug. 1985 37 p
(Contract DE-AC04-76DP-00053)
(DE85-016050; MLM-3277) Avail: NTIS HC A03/MF A01

The operational method for data treatment is illustrated: four, five, six, and seven point echo functions, formulas for extremum evaluation and location, two-dimensional echo functions, equations relating data in two-dimensional configurations, derivative methods, and programs are given. DOE

N86-23017# Joint Publications Research Service, Arlington, Va.
USSR REPORT: EARTH SCIENCES Abstracts Only
31 Mar. 1986 56 p Transl. into ENGLISH from various Russian articles
(JPRS-UES-86-004) Avail: NTIS HC A04/MF A01

Progress is reported in U.S.S.R. earth sciences. Topics discussed include (1) meteorology; (2) oceanography; (3) terrestrial geophysics; (4) atmospheric physics; and (5) artic and antarctic research.

N86-23203# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
PROCEEDINGS OF THE ARCTIC OCEANOGRAPHY CONFERENCE AND WORKSHOP HELD AT THE NAVAL OCEAN RESEARCH AND DEVELOPMENT ACTIVITY, NSTL, MS. ON JUNE 11-14, 1985
1985 293 p Conference held in Bay St. Louis, Miss., 11-14 Jun. 1985
(AD-A162578) Avail: NTIS HC A13/MF A01 CSCL 20A

The four general subject areas were: Arctic Operations and acoustics; Buoys; and Sea Ice. Included titles are: MIZEX(Marginal Ice Zone Experiment) Operations; International Ice Patrol Operations; Remote Sensing for Polar Icebreaker Navigation in Sea Ice; Satellite Telemetry Buoys for Collection of Arctic Acoustic and Environmental Data; Arctic Temperature - Conductivity Buoys; Generation and Movement of Ice Islands near the Canadian Arctic Archipelago; Effect of the Physical Properties of Ice on the High Frequency Acoustic Backscatter from an Ice Keel Model; Simulation Model for High-Frequency Underice Acoustic Backscattering; High Frequency Acoustic Reflection from Flat Sea Ice; Use of Penetrators to Estimate the Properties of Ice in Arctic Regions; Acoustic Bottom Interaction Considerations in the Arctic; Horizontal Directionality of Ice Edge Noise; Characteristics of Industrial Sounds in the Shallow Beaufort Sea; A Multi-bounce, Single-scatter, Ray

Theoretic Model for Under-ice Predictions, Frequency-domain Electromagnetic Ice-sounding; Radiometric Imagery of Sea Ice; Remote Sensing of the Marginal Ice Zone During MIZEX 83 and 84; Variations in Bering Sea Ice Coverage Related to Large-scale Atmospheric Circulation Patterns; Determining Sea Ice Type and Inferred Ice Thickness Distributions from Aerial Photographs; Pressure Ridge Morphology and Physical Properties of Sea Ice in the Greenland Sea. GRA

N86-23207# Johns Hopkins Univ., Laurel, Md. Applied Physics Lab.
STRATEGIES FOR THE CALIBRATION AND OPERATIONAL USE OF THE ERS-1 SAR WAVE MODE Final Report
A. D. GOLDFINGER Paris ESA Mar. 1985 126 p refs
Original contains color illustrations
(Contract ESTEC-5538/83)
(JHU/APL/SDO-7565; ESA-CR(P)-2097) Avail: NTIS HC A07/MF A01

Algorithms for estimating ocean wave spectra and tracking spectral peaks for ERS-1 Active Microwave instrument were studied. Procedures for calibrating the system and validating the algorithms are proposed. The ocean can be represented by a two-scale model in which random local phenomena cause small uncorrelated variations in the ocean spectrum that are superimposed on slowly changing excursions due to macroscopic effects. Macroscopic phenomena show correlation lengths of 50 to 100 km. Principal error sources in measuring spectral peak positions are: error inherent in measuring a static spectral peak; error due to dynamic tracking effects; and error due to localized ocean excursions. Two bit quantization of the SAR signals is not a significant error source. Spectra should be estimated from multilook imagery. If the number of looks is maximized, it does not matter how the fixed buffer of SAR data is broken up into subimages. Author (ESA)

N86-23208# National Science Foundation, Washington, D.C. Div. of Polar Programs.
ICE SHELVES OF ANTARCTICA
N. I. BARKOV 1985 272 p Transl. into ENGLISH from the mono. "Shelfove Ledniki Antarktidy" Leningrad, USSR, Gidrometeorologicheskoe, 1971
(PB86-106986; TT-75-52081) Avail: NTIS HC A12/MF A01 CSCL 08L

The vast areas occupied by ice shelves and their peripheral location in Antarctica have attracted the attention of investigators for long. Their special features have been studied and their role in the mass budget of the continent's ice cover examined. Information on the ice shelves, published till 1968, has been examined in the monograph. The author describes the special conditions of existence of ice shelves, their movement, morphology, charging, the structure of the thermal regime, and their contribution to the development of glaciation on the continent. In this respect, particular attention has been paid to the study of the floating, most representative, part of such ice formations. GRA

N86-23209# National Science Foundation, Washington, D.C. Div. of Polar Programs.
PROBLEMS OF THE ARCTIC AND THE ANTARCTIC, COLLECTION OF ARTICLES, VOLUME 56, 1981
A. F. TRESHNIKOV 1985 167 p Transl. into ENGLISH of Problemy Arktiki i Antarktiki (USSR), Sbornik Statei, v. 56, 1981 p 1-159
(PB86-107109; TT-82-00-102) Avail: NTIS HC A08/MF A01 CSCL 08C

Many articles included in this volume deal with various aspects of the studies on sea ice, viz., conditions of regelation, thermal displacement, deformation and stresses, hummocking, morphology, and techniques of thickness measurements. Another group of articles deals with hydrometeorological forecasts, subsurface currents, water density fields, etc. GRA

N86-23211# National Environmental Satellite Service, Washington, D. C.
ENVIRONMENTAL DATA SOURCES FOR THE CHESAPEAKE BAY AREA
Jun. 1985 66 p
(PB86-110640; NESDIS-ENVIRON-INVENT-3) Avail: NTIS HC A04/MF A01 CSCL 08C

Chesapeake Bay is one of the largest and most productive estuaries in the world. It is a unique, irreplaceable natural--as well as national--resource. Declining harvests of fish and shellfish, however, have served notice that the Bay's renewable living resources are endangered by deteriorating water quality and habitat destruction. The primary purpose of this publication is to provide information about environmental data for the Chesapeake Bay area that is available from the National Environmental Satellite, Data, and Information Service. GRA

N86-23213# National Oceanic and Atmospheric Administration, Miami, Fla. Oceanographic and Meteorological Labs.
HEAT BUDGET AND CLIMATIC ATLAS OF THE EQUATORIAL ATLANTIC OCEAN DURING FGGE (FIRST GARP GLOBAL EXPERIMENT, 1979
E. MARMOIEJO, J. F. FESTA, and R. L. MOLINAN Aug. 1985 82 p
(PB86-111622; NOAA-TM-ERL-AOML-61) Avail: NTIS HC A05/MF A01 CSCL 08J

Observations of surface oceanographic and meteorological fields collected during the first GARP Global Experiment (FGGE) in the equatorial Atlantic Ocean have been combined and averaged by month onto a 2 degree by 2 degree grid. Monthly distributions of sea-surface temperature, wind speed and direction, air temperature, specific humidity, and cloud cover have been generated for the period from December 1978 through November 1979. Net short-wave and long-wave radiation, and sensible and latent heat flux distributions have been generated from surface data using the bulk aerodynamic formulas. Standard errors of the mean values have been computed along with monthly contoured plots of each oceanographic and meteorological variable. GRA

N86-24002# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abt. Hochfrequenzverfahren.
ARCHIMEDES PROJECT REMOTE SENSING OF OIL SPILLS NORTH SEA EXPERIMENT, OCTOBER 1983. REPORT ON DFVLR (SIDE-LOOKING AIRBORNE RADAR (SLAR) CONTRIBUTION
F. WITTE Sep. 1985 30 p
(DFVLR-FB-85-54; ISSN-0171-1342) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 13

Oil pollution monitoring by SLAR was assessed in flight tests using specially created slicks. The SLAR-system demonstrates its ability to detect and image oil slicks even on a smooth water surface. The received radar backscatter as a function of surface roughness and angle of incidence fluctuates considerably, so the probability to detect oil slicks increases by using steeper depression angles than normal to obtain a large swath width. An important tool to improve the accuracy of classification is the data correction algorithm. The classification quality strongly depends on viewing direction (best perpendicular to the waves) and on the sea state. As expected VV-polarization is the preferable solution for oil slick monitoring with a SLAR. Author (ESA)

N86-24112# National Oceanic and Atmospheric Administration, Seattle, Wash. Marine Environmental Lab.
RELATIONSHIPS BETWEEN SURFACE OBSERVATIONS OVER THE GLOBAL OCEANS AND THE SOUTHERN OSCILLATION
P. B. WRIGHT, T. P. MITCHELL, and J. M. WALLACE Jan. 1985 70 p Prepared in cooperation with Washington Univ., Seattle
(PB86-110038; NOAA-DR-ERL-PMEL-12) Avail: NTIS HC A04/MF A01 CSCL 04B

The atlas contains maps of correlation and regression coefficients between seasonal anomalies of surface meteorological fields over the global oceans and Darwin, Australia annual-mean sea-level pressure anomalies. The statistics were calculated for six consecutive seasons defined relative to the Darwin index. The resulting charts provide a description of the time evolution of meteorological anomalies associated with the Southern Oscillation over the global oceans. GRA

N86-24120*# National Academy of Sciences - National Research Council, Washington, D. C. Commission on Physical Sciences, Mathematics and Resources.

PROCEEDINGS OF THE FIRST NATIONAL WORKSHOP ON THE GLOBAL WEATHER EXPERIMENT: CURRENT ACHIEVEMENTS AND FUTURE DIRECTIONS, VOLUME 1 Final Report

Oct. 1985 89 p refs Workshop held in Woods Hole, Mass., 9-20 Jul. 1984
(Contract NSF ATM-80-25329)
(NASA-CR-176720; NAS 1.26:176720) Avail: NTIS HC A05/MF A01 CSCL 04B

A summary of the proceedings in which the most important findings stemming from the Global Weather Experiment (GWE) are highlighted, additional key results and recommendations are comered, and the presentations and discussion are summarized. Detailed achievements, unresolved problems, and recommendations are included. Author

N86-24142*# National Academy of Sciences - National Research Council, Washington, D. C. Commission on Physical Sciences, Mathematics, and Resources.

PROCEEDINGS OF THE FIRST NATIONAL WORKSHOP ON THE GLOBAL WEATHER EXPERIMENT: CURRENT ACHIEVEMENTS AND FUTURE DIRECTIONS, VOLUME 2, PART 2 Final Report

Oct. 1985 414 p refs Workshop held in Woods Hole, Mass., 9-20 Jul. 1984 Sponsored in cooperation with NASA and NOAA 3 Vol.
(Contract NSF ATM-80-25329)
(NASA-CR-176722; NAS 1.26:176722; PB86-139177) Avail: NTIS HC A18/MF A01 CSCL 04B

An assessment of the status of research using Global Weather Experiment (GWE) data and of the progress in meeting the objectives of the GWE, i.e., better knowledge and understanding of the atmosphere in order to provide more useful weather prediction services. Volume Two consists of a compilation of the papers presented during the workshop. These cover studies that addressed GWE research objectives and utilized GWE information. The titles in Part 2 of this volume include General Circulation Planetary Waves, Interhemispheric, Cross-Equatorial Exchange, Global Aspects of Monsoons, Midlatitude-Tropical Interactions During Monsoons, Stratosphere, Southern Hemisphere, Parameterization, Design of Observations, Oceanography, Future Possibilities, Research Gaps, with an Appendix.

N86-24161*# Scripps Institution of Oceanography, La Jolla, Calif.

SEA SURFACE TEMPERATURE FROM SATELLITES: THE IMPACT OF FGGE Final Report

R. L. BERNSTEIN *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 p 761-764 Oct. 1985 refs
Avail: NTIS HC A18/MF A01 CSCL 04B

Spacecraft instruments first launched at the beginning of the FGGE year are now producing sea surface temperature data accurate to about 1 C. At larger scales, the errors are dominated by systematic effects, some of which are instrumental, but most are geophysical, i.e., correlated with volcanic aerosols, atmospheric water vapor, clouds, and surface wind. Progress is being made to identify and eliminate such errors and thereby provide sea surface temperature data on a global basis consistently accurate to 0.5 C, which will be needed for studies of climate variability. Author

N86-24166# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

DEVELOPMENT OF A SATELLITE-TRACKED OCEANOGRAPHIC DRIFTING BUOY FOR THE BRAZILIAN ANTARCTIC PROGRAM, PART 1

M. R. STEVENSON and E. M. B. ALONSO Feb. 1986 24 p refs Submitted for publication
(INPE-3793-PRE/888) Avail: NTIS HC A02/MF A01

The project Measurement of the Antarctic Current (MEDICA) which was to develop, build and launch drifting oceanographic buoys, located by System ARGOS, in Antarctica is presented. The basis of the drifting buoy was to used a data collection platform (DCP). A biconic geometry was used for the buoy hull to provide good vertical stability and resistance to entrapment by ice. Fiberglass was used for its high strength to weight ratio, and the facility to use molds for production of the hulls. Sandwich construction was incorporated and provided for outer and inner hulls of fiberglass with polyurethane foam between the walls. Within the hull, the DCP unit and its interface box are mounted within a metal conical rack. The transmitting antenna is mounted on a metal base-plane disc and, in turn, is secured atop the rack. A power supply, consisting of several hundred alkaline dry cells, suitably interconnected and sealed within a plastic housing, resides below the rack for maximum buoy stability. An additional thermistor is mounted in a housing on the conical cover of the buoy and provides air temperature readings. The physical specifications and measuring capabilities of the sensors. E.A.K.

N86-24168# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

COMPARISON OF CIRCULATION ESTIMATES AND WINDS BASED ON SHIPBOARD AND SATELLITE-TRACKED BUOY DATA IN BRANSFIELD STRAIT, 9-14 MARCH, 1985, PART 3

M. R. STEVENSON, H. M. INOSTROZAV, J. L. STECH, and E. M. B. ALONSO Feb. 1986 21 p refs Submitted for publication
(INPE-3795-PRE/890) Avail: NTIS HC A02/MF A01

The INPE freely drifting prototype oceanographic buoy (System ARGOS) was launched successfully on 9 March at 19:31 GMT, for a several day test experiment. During the 9 to 14 March, 1985, interval, a set of 7 hydrographic stations was made in the Bransfield Strait to obtain information about temperature, salinity and density. Results of the several day drifter trajectory are presented together with a comparison with geostrophic circulation, surface winds and air and sea temperatures. Mean drifter velocity was 27.0 cm/s toward 042 deg and confirmed a predicted NE movement for the surface water layer. The surface geostrophic current was toward 020 deg at 4 cm/s, at 10 m depth the current was toward 045 deg at 5 cm/s. Best agreement was found between the rifter trajectory and the geostrophic current at 10 m depth. At the time of buoy launch and for about one day thereafter, winds were weak and toward 090 deg; after another day, however, the surface winds changed and blew generally toward 250 deg at speeds that gradually increased up to 16 kts, in opposition to the surface water motion. Air and water temperatures measured from the buoy are also discussed and compared with measurements made at the hydrographic stations. Author

N86-24170# SACLANT ASW Research Center, La Spezia (Italy).

AN ATLAS OF ORIGINAL AND MERCATOR-TRANSFORMED SATELLITE-DATA IMAGES OF THE ALBORAN SEA, AUGUST-OCTOBER 1983

E. NACINI 1 Aug. 1985 132 p
(AD-A161898; SACLANTCEN-SR-89) Avail: NTIS HC A07/MF A01 CSCL 14E

A collection of satellite (NOAA7) images of the Alboran Sea in High Resolution Picture Transmission (HRPT) and Automatic Picture Transmission (APT) format in the visible, near-infrared, and thermal infrared fields is presented. Some of them have been transformed to Mercator projection in order to show how the use of such images can aid in the preparation and conduct of oceanographic and other operations. The contents include: image

collection and processing, transformation to Mercator projection, application to oceanographic studies, water masses, temperature profiling, comparison with synoptic weather charts, and tidal data.
GRA

N86-24172# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
OCEAN WAVE SLOPE STATISTICS FROM AUTOMATED ANALYSIS OF SUN GLITTER PHOTOGRAPHS Final Report
M. LYBANON Jun. 1985 65 p
(AD-A161995; NORDA-103) Avail: NTIS HC A04/MF A01
CSCL 08C

The image of the Sun reflected from the rough surface of the sea forms a diffuse pattern, whose details depend on the nature of the surface waves and swell. Consequently, statistics of the slope distribution of the sea surface are related to the statistics of the Sun's glitter on the sea surface. Aerial photographs are a convenient medium for recording the glitter pattern. The mathematical relationship to derive the sea surface slope statistics can be determined from an analysis of the imaging geometry. However, analysis of the photographs can be a labor-intensive procedure. The problem was first studied over thirty years ago. Now, there are modern digital image processing systems and techniques that greatly increase the practicality of the analysis. This report derives the relevant equations and describes an implementation on the Interactive Digital Satellite Image Processing System (IDSIPS). The IDSIPS system is operated by the Remote Sensing Branch of the Naval Ocean Research and Development Activity (NORDA). The report includes full formal documentation of the computer software.
Author (GRA)

N86-24173# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
CONTRIBUTIONS TO THE OCEANOGRAPHY OF THE WESTERN ALBORAN SEA Final Report
R. ARNONE, R. BARCALA, G. DAWSON, F. FIEDLER, and G. HEBURN Apr. 1985 120 p Presented at the 29th Congress and Plenary Session of the International Commission for the Scientific Exploration of the Mediterranean Sea, Lucerne, Switzerland, 11-19 Oct. 1984
(AD-A162019; NORDA-TN-315) Avail: NTIS HC A06/MF A01
CSCL 08C

This compilation includes the following articles: Donde Va? An Oceanographic Experiment in the Alboran Sea. The Donde Va Group; The Hydrographic Structure of the Alboran Sea Gyre, June and October 1982; NIMBUS-7/CZCS Derived Maps of Near-Surface Chlorophyll; The Flow of Atlantic Water into the Alboran Sea During Donde Va; A Time Series Station at the Eastern Entrance of the Strait of Gibraltar; A Preliminary Study of a Standing Interval Wave in the Western Approaches to the Strait of Gibraltar; Effects of Wind Versus Hydraulic Forcing on the Dynamics of the Western Mediterranean Sea; and Computational Methods for Two Problems in Air-Sea Interaction.
GRA

N86-24176# Naval Postgraduate School, Monterey, Calif.
HYDROGRAPHIC DATA FROM THE OPTOMA PROGRAM, OPTOMA17: OPTOMA17 P, 21 JULY 1985, OPTOMA17 LEG DI, 10-22 AUGUST 1985, OPTOMA17 LEG DII, 23 AUGUST - 5 SEPTEMBER 1985 Report, Oct. 1982 - Sep. 1985
P. A. WITTMANN, E. A. KELLEY, JR., and C. N. K. MOOERS Oct. 1985 133 p
(AD-A162067; NPS68-85-026) Avail: NTIS HC A07/MF A01
CSCL 08C

The Ocean Prediction Through Observations, Modeling and Analysis (OPTOMA) Program seeks to understand the mesoscale (fronts, eddies, and jets) variability and dynamics of the California Current System and to determine the scientific limits to practical mesoscale ocean forecasting. To help carry out the aims of this project, a series of cruises has been planned in two subdomains, NOCAL and CENCAL. The two cruises and one AXBT flight comprising OPTOMA17 were undertaken in the USNS DE STEIGUER and a Reserve Patrol Wing P3B aircraft. Hydrographic data were acquired off the coast of California in an area which covered and extended the NOCAL region. On each of these cruises, hydrographic stations were occupied at approximately 19 km along the track. For the AXBT flight, the along-track station spacing varied between about 28 km and about 46 km. Data acquired during Legs DI and DII include XBT and CTD profiles; whereas data acquired during Leg P are AXBT profiles. Bucket surface temperatures were taken at all CTD stations. A Rosette sampler was used to acquire deep salinity samples. These salinity samples were used for calibration purposes as well as contributions to the data base.
GRA

N86-24180# Lamont-Doherty Geological Observatory, Palisades, N. Y.
MARGINAL ICE ZONE EXPERIMENT - 1984, PHYSICAL OCEANOGRAPHY REPORT: USNS LYNCH AND HELICOPTER-BASED STD DATA
T. O. MANLEY Dec. 1985 291 p
(Contract N00014-84-C-0132)
(AD-A163096; LDGO-85-7) Avail: NTIS HC A13/MF A01
CSCL 08J

During the summer of 1984, the Arctic Oceanography Department of Lamont-Doherty Geological Observatory acquired a total of 222 helicopter-based C/STD stations within the ice-covered region of the Fram Strait to a nominal depth of 500 m. This program was accomplished as part of an international experiment known as MIZEX East 1984. The two ships used in helicopter operations the F/S Polarstern and the M/V Polarqueen. The USNS Lynch was also used to obtain 26 CTD stations from two separate legs into the Fram Strait. The first leg primarily consisted of an open water transect of the strait at a latitude of 79 N. Stations were typically taken to within 10 m of the bottom and extended from the ice edge onto the shelf of Svalbard. The second leg was more acoustically oriented and confined to the southern region of the Yermak Plateau. During this leg, 11 stations to a nominal depth of 450 m were taken. Standard level listings of temperature, potential temperature, salinity, sigma-t, specific volume anomaly, dynamic height, and sound velocity are given for each cast along with profiles of temperature, salinity and sigma-t.
Author (GRA)

N86-24181# Lamont-Doherty Geological Observatory, Palisades, N. Y.
PHYSICAL OCEANOGRAPHY REPORT: CAMP-BASED AND HELICOPTER-BASED STD DATA FROM THE DRIFTING ICE STATION FRAM 3
T. O. MANLEY and D. B. CAMP Dec. 1985 339 p
(Contract N00014-84-C-0132)
(AD-A163097; LDGO-85-8) Avail: NTIS HC A15/MF A01
CSCL 08J

During the spring of 1981, a manned camp was established on a drifting ice floe north of Spitzbergen. During the 61 days of occupation, the Arctic Oceanography Department of Lamont-Doherty Geological Observatory obtained a total of 194 STD stations from the combined efforts of personnel in charge of camp-based and helicopter-based operations. This report describes the methods used in the acquisition and processing of the data and provides output for each case. The output consists of standard level listings of temperature, potential temperature, salinity, sigma-t, specific volume anomaly, dynamic height, and sound velocity, along with corresponding profiles of temperature, salinity and sigma-t.
Author (GRA)

N86-24182# National Science Foundation, Washington, D.C. Div. of Polar Programs.
PROBLEMS OF THE ARCTIC AND THE ANTARCTIC, COLLECTION OF ARTICLES, VOL. 57, 1981
A. F. TRESHNIKOV, ed. 1985 151 p Transl. into ENGLISH of Sbornik Statei (USSR), v. 57, 1981 p 1-142
(PB86-106994; TT-82-00-104) Avail: NTIS HC A08/MF A01
CSCL 08C

Problems of polar oceanography; hydrochemical studies in the Arctic Ocean; general distribution variability of ice in the World Ocean as a climate-forming factor; air-sea interaction in the Arctic basin and the North Atlantic; physics of ice and the ocean; long-range meteorological forecasts are reported. GRA

N86-25100*# Applied Science Associates, Inc., Apex, N.C.
STUDIES RELATED TO OCEAN DYNAMICS. TASK 3.2: AIRCRAFT FIELD TEST PROGRAM TO INVESTIGATE THE ABILITY OF REMOTE SENSING METHODS TO MEASURE CURRENT/WIND-WAVE INTERACTIONS Final Report
N. E. HUANG, W. A. FLOOD, and G. S. BROWN May 1975 74 p refs
(Contract NAS6-2520)
(NASA-CR-168349; NAS 1.26:168439) Avail: NTIS HC A04/MF A01 CSCL 08C

The feasibility of remote sensing of current flows in the ocean and the remote sensing of ocean currents by backscattering cross section techniques was studied. It was established that for capillary waves, small scale currents could be accurately measured through observation of wave kinematics. Drastic modifications of waves by changing currents were noted. The development of new methods for the measurement of capillary waves are discussed. Improvement methods to resolve data processing problems are suggested. E.A.K.

N86-25104# Hawaii Inst. of Geophysics, Honolulu.
MONTHLY MAPS OF SEA LEVEL ANOMALIES IN THE PACIFIC, 1975 1981. REPORT ON THE IGOSS (INTEGRATED GLOBAL OCEAN SERVICES SYSTEM) SEA LEVEL PILOT PROJECT
K. WYRTKI and S. NAKAHARA Aug. 1984 96 p
(Contract NA80RA-H-00002)
(AD-A163061; HIG-84-3; JIMAR-84-0085) Avail: NTIS HC A05/MF A01 CSCL 08C

Sea level data obtained on islands in the tropical and subtropical Pacific Ocean are used to compile maps of the sea level anomaly for each month of the period January 1975 to December 1981. The maps reveal the large horizontal coherence of sea level anomalies with space scales of several thousand kilometers. Coherence scales are larger in the east-west than in the north-south direction. The anomalies are also coherent over many months indicating a dominance of low-frequency variations. GRA

N86-25106# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
MANAGEMENT INFORMATION (WAVE PROPAGATION LABORATORY, BOULDER, COLORADO)
Oct. 1985 50 p
(PB86-139524) Avail: NTIS HC A03/MF A01 CSCL 08C

The nation's geophysical research and service is to be improved through creation and application of new remote measurement systems. Essential functions include: Wave propagation studies; Technique development; Atmospheric and Oceanic research; Technology transfer. GRA

N86-25939# National Oceanic and Atmospheric Administration, Seattle, Wash. Marine Environmental Lab.
SEA ICE DYNAMICS AND REGIONAL METEOROLOGY FOR THE ARCTIC POLYNYA EXPERIMENT (APEX)-BERING SEA 1985
C. H. PEASE, M. REYNOLDS, G. A. GALASSO, V. L. LONG, and S. A. SALO Oct. 1985 129 p
(PB86-148036; NOAA-TM-ERL-PMEL-64) Avail: NTIS HC A07/MF A01 CSCL 04B

The purpose of the Artic Polynya Experiment (APEX) is to investigate physical processes and thermodynamics in the atmosphere, sea ice, and ocean in the vicinity of St. Lawrence Island in the northern Bering Sea. The relative importance on sea ice motion of baroclinic currents due to brine rejection during the freezing of ice in the polynya, barotropic currents due to set-up on the shelf, internal ice stress due to the presence of St. Lawrence Island, wind stress and Coriolis force are being considered through a measurement and modeling program. GRA

N86-25962# Marine Research Inst., Helsinki (Finland).
INVESTIGATION OF ICE DYNAMICS IN THE MARGINAL ICE ZONE Interim Report, 16 May - 30 Sep. 1985
M. LEPPAERANTA 30 Sep. 1985 11 p refs
(Contract DAJA45-83-C-0034)
(AD-A164384; IR-6) Avail: NTIS HC A02/MF A01 CSCL 08L

MIZEX-83 was a pilot study program in the Greenland Sea where ice kinematics data could be collected for about ten days. Ocean current measurements were simultaneously made beneath the same ice floes as we had transponders for the ice kinematics at three stations. The currents were measured with Aanderaa current recorders giving the mean absolute speed and instantaneous direction at ten-minute intervals. The ice kinematics data describe relative motion between the stations. Thus in comparing ice and current kinematics we consider the relative motion, i.e., spatial fluctuations of velocity between two stations and the rate of deformation given by the three stations. The active role of ice in the ice-ocean system has a consequence that an ocean dynamics model for the ice margin problems should have an advanced ice dynamics model coupled with it. The ice motion was also measured with Argos satellite buoys. They are very good for measuring trajectories. GRA

N86-26313# Pacific Missile Test Center, Point Mugu, Calif.
NAVSTAR GPS (GLOBAL POSITIONING SYSTEM) ACCURACY WHILE SURVEYING ARRAYS OF DEEP OCEAN TRANSPONDERS
L. A. ANDERSON Dec. 1985 21 p
(AD-A163364; PMTC-TP-000037) Avail: NTIS HC A02/MF A01 CSCL 17G

The observed accuracy of the Navstar GPS Global Positioning System when used with acoustic data to geodetically locate arrays of bottom-mounted ocean transponders is presented. Two arrays were to be located, and each was surveyed on several separate occasions. In addition to GPS with dual frequency precise P-code, the arrays were located by using Argo, Syledis, Transit satellites, and by several other tracking methods. Because the array positions have been well determined, the data is now able to reveal the absolute GPS fix error while at sea. For one survey, ground truth information from the Yuma GPS facility, 263 nautical miles (487 km) away, was used to reduce measurement bias. GRA

N86-26517# Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
METHODS OF OBTAINING OFFSHORE WIND DIRECTION AND SEA-STATE DATA FROM X-BAND AIRCRAFT SAR (SYNTHETIC APERTURE RADAR) IMAGERY OF COASTAL WATERS
G. A. MASTIN, C. A. HARLOW, O. K. HUH, and S. A. HSU Apr. 1985 18 p
(Contract N00014-83-C-0150)
(AD-A165552; TR-410) Avail: NTIS HC A02/MF A01 CSCL 17I

X-band synthetic aperture radar (SAR) imagery of the Goto Islands of Japan was digitally analyzed to extract air-sea interaction parameters and to assess the potential of texture measures in analysis of SAR ocean imagery. Wind direction is extracted from wind rows, wind streaks, and random turbulence patterns observed in the SAR imagery. Sea-state parameters are either extracted directly from the imagery or estimated using the extracted information in previously established empirical formulas. A convenient method of digitally presenting imagery, local power spectra, and the extracted/estimated parameters is presented. Texture analysis based on gray-level co-occurrence (GLC) matrices is applied to SAR ocean imagery. The inertia measure is shown to extract similar information to the power spectrum. The cluster-shade measure is shown to be sensitive to image phase. GRA

N86-26670*# University of South Florida, St. Petersburg. Dept. of Marine Science.
A SIMULATION ANALYSIS OF THE FATE OF PHYTOPLANKTON WITHIN THE MID-ATLANTIC BIGHT
J. J. WALSH, D. A. DIETERLE, and M. B. MEYERS 1986 62 p
(Contract NAGW-678)
(NASA-CR-177265; NAS 1.26:177265) Avail: NTIS HC A04/MF A01 CSCL 08A

A time-dependent, three-dimensional simulation model of wind-induced changes of the circulation field, of light and nutrient regulation of photosynthesis, of vertical mixing as well as algal sinking, and of herbivore grazing stress, is used to analyze the seasonal production, consumption, and transport of the spring bloom within the mid-Atlantic Bight. The particular case (c) of a 58-day period in February-April 1979, simulated primary production, based on both nitrate and recycled nitrogen, with a mean of 0.62 g C sq m/day over the whole model domain, and an export at the shelf-break off Long Island of 2.60 g ch1 sq m/day within the lower third of the water column. About 57% of the carbon fixation was removed by herbivores, with 21% lost as export, either downshelf or offshore to slope waters, after the first 58 days of the spring bloom. Extension of the model for another 22 days of case (c) increased the mean export to 27%, while variation of the model's parameters in 8 other cases led to a range in export from 6% to 38% of the average primary production. Spatial and temporal variations of the simulated algal biomass, left behind in the shelf water column, reproduced chlorophyll fields sensed by satellite, shipboard, and in situ instruments. Author

N86-26716# Coast Guard, Washington, D.C.
A REVIEW OF METHODS TO TRACK OIL IN ARCTIC WATERS Final Report
J. W. ST.MARTIN Jun. 1985 25 p refs
(AD-A164679; USCG-D-28-85) Avail: NTIS HC A02/MF A01 CSCL 13B

A review of available literature on the tracking of oil in Arctic environments was conducted. The effectiveness of satellite and aircraft mounted detection devices used in locating oil-on-water, ice or in an ice/water mixture was examined. Oil spill tracking buoys and devices, both micro and macro scale, were also reviewed with their applicability to the Arctic environment detailed. Recommendations were made for the U.S. Coast Guard to use ARGOS system buoys on Arctic oil spills for long term tracking of movement. An additional recommendation was made for the future testing of the HU-25A mounted AIREYE surveillance system or an HC-130 mounted sensor package on oil spilled in an Arctic environment. Author (GRA)

N86-26758*# Florida State Univ., Tallahassee. Dept. of Meteorology.
AN INVESTIGATION OF THE MARINE BOUNDARY LAYER DURING COLD AIR OUTBREAK Final Report
S. A. STAGE Jul. 1986 26 p refs
(Contract NAG5-332)
(NASA-CR-177287; NAS 1.26:177287) Avail: NTIS HC A03/MF A01 CSCL 04B

Methods for use in the remote estimation of ocean surface sensible and latent heat fluxes were developed and evaluated. Three different techniques were developed for determining these fluxes. These methods are: (1) Obtaining surface sensible and latent heat fluxes from satellite measurements; (2)Obtaining surface sensible and latent heat fluxes from an MABL model; (3) A method using horizontal transfer coefficients. These techniques are not very sensitive to errors in the data and therefore appear to hold promise of producing useful answers. Questions remain about how closely the structure of the real atmosphere agrees with the assumptions made for each of these techniques, and, therefore about how well these techniques can perform in actual use. The value of these techniques is that they promise to provide methods for the determination of fluxes over regions where very few traditional measurement exist. E.R.

N86-26782*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBJECTIVE ANALYSIS OF TIDAL FIELDS IN THE ATLANTIC AND INDIAN OCEANS
B. V. SANCHEZ, D. B. RAO (National Meteorological Center, Washington, D.C.), and S. D. STEENROD (Applied Research Corp., Landover, Md.) Jun. 1986 25 p refs
(NASA-TM-87773; NAS 1.15:87773; REPT-86B0195) Avail: NTIS HC A02/MF A01 CSCL 08C

An objective analysis technique has been developed to extrapolate tidal amplitudes and phases over entire ocean basins using existing gauge data and the altimetric measurements which are now beginning to be provided by satellite oceanography. The technique was previously tested in the Lake Superior basin. The method has now been developed and applied in the Atlantic-Indian ocean basins using a 6 deg x 6 deg grid to test its essential features. The functions used in the interpolation are the eigenfunctions of the velocity potential (Proudman functions) which are computed numerically from a knowledge of the basin's bottom topography, the horizontal plan form and the necessary boundary conditions. These functions are characteristic of the particular basin. The gravitational normal modes of the basin are computed as part of the investigation, they are used to obtain the theoretical forced solutions for the tidal constituents, the latter provide the simulated data for the testing of the method and serve as a guide in choosing the most energetic modes for the objective analysis. The results of the objective analysis of the M2 and K1 tidal constituents indicate the possibility of recovering the tidal signal with a degree of accuracy well within the error bounds of present day satellite techniques. Author

N86-26783*# Alaska Univ., Anchorage.
INFLUENCE OF THE YUKON RIVER ON THE BERING SEA Progress Report
K. DEAN and C. P. MCROY 1986 12 p refs Original contains color illustrations
(Contract NAS5-28769)
(NASA-CR-177310; NAS 1.26:177310) Avail: NTIS HC A02/MF A01 CSCL 10C

The relationships between the discharge of the Yukon River to the currents and biological productivity in the northern Bering Sea were studied. Specific objectives were: to develop thermal, sediment, and chlorophyll surface maps using Thematic Mapper (TM) data of the discharge of the Yukon River and the Alaskan Coastal Current during the ice free season; to develop a historical model of the distribution of the Yukon River discharge and the Alaskan Coastal Current using LANDSAT Multispectral band scanner (MSS) and NOAA satellite imagery; and to use high resolution TM data to define the surface dynamics of the front between the Alaskan Coastal Current and the Bering Shelf/Anadyr Current. LANDSAT MSS, TM, and Advanced Very High Resolution Radiometer (AVHRR) data were recorded during the 1985 ice free period. The data coincided with shipboard measurements acquired by Inner Shelf Transfer and Recycling (ISTAR) project scientists. An integrated model of the distribution of turbid water discharged from the Yukon River was compiled. A similar model is also being compiled for the Alaskan Coastal and Bering Shelf/Anadyr water masses based on their thermal expressions seen on AVHRR imagery. B.G.

N86-26788# Science Applications International Corp., College Station, Tex.
A STUDY OF SEA ICE KINEMATICS AND THEIR RELATIONSHIP TO ARCTIC AMBIENT NOISE. PART 3, SECTION 1: AMBIENT NOISE. SECTION 2: AMBIENT NOISE Final Report, Mar. 1985 - Feb. 1986
J. K. LEWIS and W. W. DENNER Feb. 1986 327 p
(Contract N00014-85-C-0531)
(AD-A165304; AD-E301922; SAIC-85/1950-PT-3; SAIC-1-425-07-356-10-PT-3-SE) Avail: NTIS HC A15/MF A01 CSCL 08L

This report details the kinematic analysis of sea ice motion data collected during the Arctic Ice Dynamics Joint Experiment

(AIDJEX) in the Beaufort Sea. In addition, relationships between the ice kinematic parameters and associated ambient noise are presented. These relationships were determined by an extensive correlation process between the noise and ice motion time histories. Time scales of the various modes of ice motion were calculated by season. Also, seasonal time and space scales were calculated for ambient noise at 10 Hz, 32 Hz, and 1000 Hz. Contents of this section include: Seasonal Arctic Ambient Noise Variations, Beaufort Sea, 1975-1976; Two-Dimensional Contour Maps of Arctic Ambient Noise Variations, 8-9 August 1975 (Summer); and Two-Dimensional Contour Maps of Arctic Ambient Noise Variations, 16-17 November 1975 (Fall). GRA

N86-26789# Science Applications International Corp., College Station, Tex.
A STUDY OF SEA ICE KINEMATICS AND THEIR RELATIONSHIP TO ARCTIC AMBIENT NOISE. PART 3, SECTION 3: AMBIENT NOISE Final Report, Mar. 1985 - Feb. 1986
J. K. LEWIS and W. W. DENNER Feb. 1986 107 p
(Contract N00014-85-C-0531)
(AD-A165305; AD-E301922; SAIC-85/1950-PT-3-SEC-3; SAIC-1-425-07-356-10-PT-3-2) Avail: NTIS HC A06/MF A01 CSCL 08L

This report details the kinetic analysis of sea ice motion data collected during the Arctic Ice Dynamics Joint Experiment (AIDJEX) in the Beaufort Sea. In addition, relationships between the ice kinematic parameters and associated ambient noise are presented. These relationships were determined by an extensive correlation process between the noise and ice motion time histories. Time scales of the various modes of ice motion were calculated by season. Also, seasonal time and space scales were calculated for ambient noise at 10 Hz, 32 Hz, and 1000 Hz. Contents of this section include: Seasonal Arctic Ambient Noise Temporal Autocorrelations, Beaufort Sea, 1975-1976; Seasonal Arctic Ambient Noise Spatial Autocorrelations, Beaufort Sea, 1975-1976; Seasonal Arctic Ambient Noise Power Spectra, Beaufort Sea, 1975-1976. GRA

N86-26791# Massachusetts Inst. of Tech., Cambridge. Marine Industry Advisory Services.
REMOTE SENSING AND OCEANOGRAPHIC EQUIPMENT TECHNOLOGY: SOME PRESENT SYSTEMS AND FUTURE NEEDS, REVISED
1 Aug. 1985 24 p Sponsored by NOAA
(Contract NA84AA-D-00046)
(PB86-156502; MITSG-85-21; OPPORTUNITY-BRIEF-41) Avail: NTIS HC A02/MF A01 CSCL 08C

Satellite sensing systems offer new capabilities for obtaining synoptic data which can be used for understanding the dynamics of the ocean. While satellites have expanded our potential for exploring the ocean, they have also increased the demand for extensive in situ measurements (footprints or 'ground truth') to calibrate the remotely observed data. Used together with computer models, in situ measurements and satellite measurements provide new insights into the dynamics of the ocean, such as the motions of warm core rings north of the Gulf Stream. Modelling, satellite imagery and in situ measurements are being combined in ways which promise very significant advances in studying natural phenomena. GRA

N86-27414# National Oceanic and Atmospheric Administration, Washington, D. C.
NOAA SATELLITE REQUIREMENTS FORECAST Final Report
D. COTTER, L. FISHER, D. MONTGOMERY, T. PYLE, and F. ZBAR May 1985 119 p
(AD-A165244) Avail: NTIS HC A06/MF A01 CSCL 22B

Environmental satellites have been an essential component of NOAA's global observing system for 25 years. This report offers a projection of NOAA's requirements for satellite data and services covering the next 15 years. These requirements derive from the mission responsibilities of NOAA's public service and research agencies; the National Weather Service, the National Ocean Service, the National Marine Fisheries Service, and the Office of Oceanic and Atmospheric Research. The National Environmental Satellite, Data, and Information Service operates the Polar-orbiting Operational Environmental Satellite (POES) and Geostationary Operational Environmental Satellite (GOES) systems and provides data archive and distribution services to the public and private sectors. The satellite support needed to help meet their mission goals through the end of this century are presented as they have been identified by each agency. The requirements specified in this report will be a major factor in the long-range planning for NOAA's future satellite programs. Author (GRA)

N86-27694# Meteorological Satellite Center, Tokyo (Japan).
METEOROLOGICAL SATELLITE CENTER TECHNICAL NOTE, NO. 13, 1986
Mar. 1986 73 p In ENGLISH and JAPANESE
(ISSN-0388-9653) Avail: NTIS HC A04/MF A01

Two articles are presented, one addressing the land-sea contrast in the Earth radiation budget and the other discussing the Cb cloud vortical pattern apart from a typhoon pressure center. In addition, a bibliography of references dealing with the use of satellite data in practical work and research is given.

N86-27695# Meteorological Satellite Center, Tokyo (Japan).
ON LAND-SEA CONTRAST IN THE EARTH RADIATION BUDGET
I. KUBOTA and H. IMAI *In its* Meteorological Satellite Center Technical Note, no. 13, 1986 (ISSN-0388-9653) p 1-31 Mar. 1986 In JAPANESE; ENGLISH summary
Avail: NTIS HC A04/MF A01

In order to make clear the difference between the Earth's radiation budget over land and over sea, three components of the budget; absorbed solar radiation, emitted terrestrial radiation, and net total radiation N on the Earth-atmosphere system measured by the wide field of view sensor aboard NIMBUS 7 were analyzed for the period during November 1978 to October 1979. The resultant zonal averages over each land and sea showed following facts. Both S and N in the latitudinal range 40 degrees around the solar declination are above 40 W/sq m larger over the sea than over land. The excess of S over sea beyond land stems mainly from differences of both clear-sky albedo and cloud amount between over land and over sea. In the latitudinal range 30 degrees centered 60N or 60S, S over land in summer is above 15 W/sq m greater then over sea contrary to the low latitudes. Finally, examination of latitudinal variation of T all the year round shows that there are a minimum zone near the equator corresponding to ITCZ, and a maximum zone in the subtropical area of each hemisphere corresponding to the subtropical high pressures or the downward stream branches of the direct circulation. The minimum in the zonal monthly average over land tends to be lower than over sea and the both maximums over land tend to be greater than over sea. These facts show that the direct circulation over land looks more active than over sea. Author

N86-27697 GKSS-Forschungszentrum Geesthacht (West Germany).
ON THE INFORMATION CONTENT OF MULTISPECTRAL RADIANCE MEASUREMENTS OVER AN OCEAN
J. FISCHER 1985 16 p Repr. from International Journal of Remote Sensing, v. 6, no. 5, 1985 p 773-786 In GERMAN
(GKSS-85/E/43; ISSN-0344-9629; ESA-86-96898) Avail: Issuing Activity

An eigenvalue analysis and a multivariate significance test are applied to the problem of measuring suspended matter, phytoplankton, and yellow substance from ship, aircraft, or satellite. The number of linearly independent pieces of information is inferred from multispectral radiance measurements at six wavelengths within the visible part of the spectrum. The radiances analyzed are calculated with a radiative transfer model (matrix operator method) for an atmosphere-ocean system and realistic variations of scattering and absorption by hydrosols in ocean waters, as well as maritime atmospheric aerosols. Instrumental errors and errors in atmospheric correction strongly determine the information content. The wavelength dependence of both errors is taken into account. Depending on atmospheric and oceanic turbidity, at most 2 independent optical parameters of water substances can be derived with an accuracy of a factor of 2 from multispectral radiance measurements made at a height of 10 km. ESA

N86-27699*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SATELLITE DETECTION OF PHYTOPLANKTON EXPORT FROM THE MID-ATLANTIC BIGHT DURING THE 1979 SPRING BLOOM

J. J. WALSH (University of South Florida, St. Petersburg.), D. A. DIETERLE, and W. E. ESAIAS Feb. 1986 53 p Sponsored in part by DOE and NOAA
(NASA-TM-88782; NAS 1.15:88782) Avail: NTIS HC A04/MF A01 CSCL 08A

Analysis of Coastal Zone Color Scanner (CZCS) imagery confirms shipboard and in situ moored fluorometer observations of resuspension of near-bottom chlorophyll within surface waters (1 to 10 m) by northwesterly wind events in the mid-Atlantic Bight. As much as 8 to 16 micrograms chl/l are found during these wind events from March to May, with a seasonal increase of algal biomass until onset of stratification of the water column. Rapid sinking or downwelling apparently occurs after subsequent wind events, however, such that the predominant surface chlorophyll pattern is approx. 0.5 to 1.5 micrograms/l over the continental shelf during most of the spring bloom. Perhaps half of the chlorophyll increase observed by satellite during a wind resuspension event represents in-situ production during the 4 to 5 day interval, with the remainder attributed to accumulation of algal biomass previously produced and temporarily stored within near-bottom water. Present calculations suggest that about 10% of the primary production of the spring bloom may be exported as ungrazed phytoplankton carbon from mid-Atlantic shelf waters to those of the continental slope. Author

N86-27700*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.

HIGH FREQUENCY SAMPLING OF THE 1984 SPRING BLOOM WITHIN THE MID-ATLANTIC BIGHT: SYNOPTIC SHIPBOARD, AIRCRAFT, AND IN SITU PERSPECTIVES OF THE SEEP-I EXPERIMENT

J. J. WALSH (University of South Florida, St. Petersburg), C. D. WIRICK (Brookhaven National Lab., Upton, N. Y.), L. J. PIETRAFESA (North Carolina State Univ., Raleigh.), T. E. WHITLEDGE (Texas Univ., Port Aransas), F. E. HOGE, and R. N. SWIFT (EG and G Washington Analytical Services Center, Inc., Pocomoke City, Md.) 1986 56 p
(NASA-TM-88765; NAS 1.15:88765) Avail: NTIS HC A04/MF A01 CSCL 08A

Moorings of current meters, thermistors, transmissometers, and fluorometers on the mid-Atlantic shelf, south of Long Island, suggest a cumulative seaward export of perhaps 0.35 g C/sq m/day between the 80 and 120 m isobaths during February-April 1984. Such a horizontal loss of algal carbon over the lower third of the water column would be 23 to 78% of the March-April 1984 primary production. This physical carbon loss is similar to daily grazing losses from zooplankton of 32-40% of the algal fixation of carbon. Metabolic demands of the benthos could be met by just the estimated fecal pellet flux, without direct consumption of algal carbon, while bacterioplankton needs could be served by excretory release of dissolved organic matter during photosynthesis. Sediment traps tethered 10 m off the bottom at the 120 m isobath and 50 m above the 500 m isobath caught as much as 0.16 to 0.26 g C /sq m/day during March-April 1984, in reasonable agreement with the flux estimated from the other moored instruments. Author

N86-27837*# Florida State Univ., Gainesville. Dept. of Meteorology.

A MODEL FOR THE ESTIMATION OF THE SURFACE FLUXES OF MOMENTUM, HEAT AND MOISTURE OF THE CLOUD TOPPED MARINE ATMOSPHERIC BOUNDARY LAYER FROM SATELLITE MEASURABLE PARAMETERS M.S. Thesis

D. E. ALLISON Aug. 1984 73 p
(Contract NAG5-332)
(NASA-CR-177283; NAS 1.26:177283) Avail: NTIS HC A04/MF A01 CSCL 04A

A model is developed for the estimation of the surface fluxes of momentum, heat, and moisture of the cloud topped marine atmospheric boundary layer by use of satellite remotely sensed parameters. The parameters chosen for the problem are the integrated liquid water content, q sub li, the integrated water vapor content, q sub vi, the cloud top temperature, and either a measure of the 10 meter neutral wind speed or the friction velocity at the surface. Under the assumption of a horizontally homogeneous, well-mixed boundary layer, the model calculates the equivalent potential temperature and total water profiles of the boundary layer along with the boundary layer height from inputs of q sub li, q sub vi, and cloud top temperature. These values, along with the 10m neutral wind speed or friction velocity and the sea surface temperature are then used to estimate the surface fluxes. The development of a scheme to parameterize the integrated water vapor outside of the boundary layer for the cases of cold air outbreak and California coastal stratus is presented. Author

N86-27838*# Florida State Univ., Tallahassee. Dept. of Meteorology.

AN INVESTIGATION OF THE MARINE BOUNDARY LAYER DURING COLD AIR OUTBREAK Final Report

S. A. STAGE Jul. 1986 26 p
(Contract NAG5-332)
(NASA-CR-177249; NAS 1.26:177249) Avail: NTIS HC A03/MF A01 CSCL 04A

Three techniques were developed and tested for use in the remote estimation of ocean surface heat and vapor fluxes. Methods for measurement of surface sensible and latent heat fluxes discussed include: satellite measurement, marine atmospheric boundary layer (MABL) model, and horizontal transfer coefficients. The accuracy and applicability of the methods are examined. Publications and papers are listed. B.G.

N86-27853*# Florida State Univ., Tallahassee. Coll. of Arts and Sciences.

A MODEL FOR THE ESTIMATION OF THE SURFACE FLUXES OF MOMENTUM, HEAT, AND MOISTURE OF THE CLOUD-TOPPED MARINE ATMOSPHERIC BOUNDARY LAYER FROM SATELLITE MEASURABLE PARAMETERS M.S. Thesis

D. E. ALLISON Aug. 1984 74 p
(Contract NAG5-332)
(NASA-CR-177290; NAS 1.26:177290) Avail: NTIS HC A04/MF A01 CSCL 04B

A model for the estimation of the surface fluxes of momentum, heat, and moisture of the cloud topped marine atmospheric boundary laryer was developed by use of satellite remotely sensed prarameters. The parameters chosen for the problem were the integrated liquid water content, the integrated water vapor content, the cloud top temperature, the sea surface temperature, and either a measure of the 10 meter neutral wind spread or the friction velocity at the surface. Under the assumptions of a horizontally homogeneous, well-mixed boundary layer, the model calculates the equivalent potential temperature and total water profiles of the boundary layer along with the boundary layer height. The development of a scheme to parameterize the integrated water vapor outside of the boundary layer for the cases of cold air outbreak and California coastal stratus is presented. Sensitivity studies are presented showing the potential accuracy of this technique. With improvements of current technology, the model will provide reasonable estimates of the surface fluxes. Author

06

HYDROLOGY AND WATER MANAGEMENT

Includes snow cover and water runoff in rivers and glaciers, saline intrusion, drainage analysis, geomorphology of river basins, land uses, and estuarine studies.

A86-33505

LARGE AREA SNOWMELT RUNOFF SIMULATIONS BASED ON LANDSAT-MSS DATA

M. F. BAUMGARTNER (Zuerich, Eidgenoessische Technische Hochschule; Zuerich, Universitaet, Zurich, Switzerland), K. SEIDEL, H. HAEFNER, K. I. ITTEN (Zuerich, Universitaet, Zurich, Switzerland), and J. MARTINEC (Eidgenoessisches Institut fuer Schneeund Lawinenforschung, Weissfluhjoch-Davos, Switzerland) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 30-38. refs

Attention is given to a method for the processing of satellite remote sensing images, as well as to a snowmelt runoff simulation by the Matinec-Rango (1983) model on the basis of such data. The primary problems addressed were those of (1) the morphological and climatological complexity of basins in the Swiss Alps, and (2) the requirement of at least four snow cover evaluations during the snowmelt period, which requires the use of incomplete satellite scenes. The changing extent of seasonal snow cover is an important variable for the snowmelt-runoff model. O.C.

A86-33613

100 MHZ DIELECTRIC CONSTANT MEASUREMENTS OF SNOW COVER DEPENDENCE ON ENVIRONMENTAL AND SNOW PACK PARAMETERS

B. A. BURNS, R. W. LARSON (Michigan, Environmental Research Institute, Ann Arbor), R. G. ONSTOTT (Kansas, University, Lawrence), and D. J. FISK (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, NH) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 829-834.
(Contract N00014-81-C-0295)

Research is reported aimed at determining the relationship between the dielectric constant and environmental parameters including physical properties of snow cover and local meteorological variables. It is necessary to understand how snow properties affect remote sensing signatures in order to use microwave remote sensors to find snow depth, snow water equivalent, and coverage. For a given frequency, the dielectric constant of snow is a function of the temperature, density and grain size of the snow and its liquid water content. Results presented are based on measurements made in SE Michigan and at CRREL, during MIZEX '84 and the 1985 USGS-NASA passive microwave study of the Colorado snow pack. Both the masking and the information aspect of the snow cover problem are represented by the experiments. All dielectric constant measurements were made with a 100 MHz Q-meter system developed at ERIM. An alcohol calorimetry technique developed at CRREL (Fisk, 1983) was used to measure liquid water content. D.H.

A86-33615

MILLIMETER-WAVE BACKSCATTER FROM SNOWCOVER

L. D. WILLIAMS (Aberdeen, University, Scotland), R. V. BIRNIE (Macaulay Institute for Soil Research, Aberdeen, Scotland), and J. G. GALLAGHER (Royal Signals and Radar Establishment, Malvern, England) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 842-847. refs

Ground-truth measurements of snowcover properties were made in Bavaria in 1984 in support of helicopter-mounted radar measurements of 80 GHz and 94 GHz backscattering from the snowcover. The variation of the backscattering coefficient with surface snow properties is investigated in this paper by stepwise multiple regression. Similar qualitative results are obtained for 80 GHz and for six polarization combinations of 94 GHz. For wet snow, the backscattering coefficient increased by 4-7 dB per mm surface roughness increase, and decreased by 0.2-1.1 dB per 1 percent increase in volumetric liquid water content. For dry snow, the backscattering coefficient decreased with increasing grain size (contrary to expectation) by 1-2 dB per mm, and did not depend on surface roughness. In a few cases (both wet and dry), porosity makes a small but statistically significant contribution to the regression, the backscattering coefficient increasing by 0.1 dB per 1 percent increase in porosity. Author

A86-33616

REMOTE SENSING OF SNOW WATER EQUIVALENT USING NIMBUS-7 SMMR DATA

M. HALLIKAINEN and P. JOLMA (Helsinki University of Technology, Espoo, Finland) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 850-855.

Nimbus-7 Scanning Multichannel Microwave Radiometer (SMMR) data have been applied to remote sensing studies of seasonal snow cover in Finland. An algorithm has been developed to retrieve the water equivalent of dry snow cover from SMMR data. The algorithm takes into account the influence of land-cover categories (forest, etc.) on the brightness temperature of snow-covered terrain. SMMR data for two winters show that three distinct classes can be observed in the microwave behavior of snow-covered terrain: early and mid-winter, spring (after several melt-freeze cycles), and melting period (wet snow). Substantial differences in the behavior between consecutive winters may occur. Author

A86-33617

ICE CONDITIONS ON THE OHIO AND ILLINOIS RIVERS, 1972-1985

L. W. GATTO (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, NH) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 856-861. Army-supported research.

A part of the Corps of Engineers' River Ice Management (RIM) program is discussed, with objectives to document ice conditions along the Ohio and Illinois Rivers from 1972 to 1985. The ice data are required for developing an ice forecasting model, for evaluating remote sensing systems, and for other projects in the RIM program. Images obtained using the Landsat Multispectral Scanner (MSS), Return Beam Vidicon (RBV) and Thematic Mapper (TM) were studied. Despite problems of cloud cover and orbital configurations that limited image taking opportunities, Landsat imagery analysis provides a historical view of general ice conditions. For many rivers this may be the only source of data on past ice conditions. Because of the shortcomings of the Landsat imagery and the success of mapping ice on the Ohio during the winter of 1984-85 with video, ice conditions will be mapped in the future from videotapes taken from a low-flying aircraft. D.H.

A86-33630

PHYSICAL INTERPRETATION OF ESTUARINE WATER COLOR USING VECTOR ANALYSIS OF SATELLITE DATA

R. P. STUMPF (NOAA, Assessment and Information Services Center, Washington, DC) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 971-976. refs

An approximately linear relationship between the spectral bands is found in viewing satellite data of estuarine water in spectral space. The relationship may be treated in vector form. By applying a turbid water expression for the irradiant reflectance, one can obtain expressions that explain the spectral relationship, i.e., the vector orientation, in terms of absorption. Changes in vector orientation depend on variations in pigment concentrations, whereas sediment concentration determines the vector's magnitude. The technique provides a physical separation between sediment and pigments in turbid water. By using the unit vector, one can estimate relative quantities of pigments in Chesapeake and Delaware Bays and identify blooms. D.H.

A86-36193* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OPTIMIZED RETRIEVALS OF PRECIPITABLE WATER FIELDS FROM COMBINATIONS OF VAS SATELLITE AND CONVENTIONAL SURFACE OBSERVATIONS

W. D. ROBINSON, D. CHESTERS, and L. W. UCCELLINI (NASA, Goddard Space Flight Center, Greenbelt, MD) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, April 20, 1986, p. 5305-5318. NASA-supported research. refs

VISSR (visible and infrared spin-scan radiometer) atmospheric sounder (VAS) radiances and conventional surface temperature and dewpoint data are used in several combinations within a regression approach to determine the optimum resolution and accuracy of precipitable water (PW) fields retrieved from satellite observations. Point retrievals at radiosonde stations are used to determine the numerical accuracy of each retrieval technique, and image sequences of the retrieved PW fields are used to determine the temporal stability and spatial coherence of mesoscale PW features. VAS channels 5, 6, 7, and 8 and the surface dewpoint contribute the most information to regression-based retrievals of PW. The most accurate PW retrievals are obtained when radiances are averaged to a resolution of 15 to 60 km. A physical 'split-window' approach provides better PW estimates than regression when only the 11- and 12-micron VAS channels are available or when radiosonde-based training is limited to only one time period. Author

A86-36234#

ESTIMATION OF MONTHLY RAINFALL FROM SATELLITE-OBSERVED CLOUD AMOUNT IN THE TROPICAL WESTERN PACIFIC

T. MARUYAMA, T. NITTA, and Y. TSUNEOKA (Meteorological Research Institute, Tsukuba, Japan) Meteorological Society of Japan, Journal (ISSN 0026-1165), vol. 64, Feb. 1986, p. 147-153. refs

A86-37010

HYDROLOGIC MODELING USING LANDSAT MSS DATA

D. P. ALEXANDER (Rural Water Commission, East Doncaster, Australia) and A. RAMACHANDRA RAO (Purdue University, West Lafayette, IN) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 103-111. refs

A hydrologic analysis procedure for simulating the rainfall-runoff process is described. Landsat data are employed to define land cover classes. The development of a data bank to store land use classification data and the utilization of the HEC-1 Flood Hydrograph Package computer program to calculate flood hydrographs and the Hydrolic Parameters program to access the data bank are examined. This procedure is applied to the Sugar Creek Watershed in Indiana. It is observed that land cover clasifications developed from satellite or airborne scanner digital data are useful for classifying land use characteristics. I.F.

A86-37012

THE STUDY OF THE NATURAL GEOGRAPHIC DIFFERENCES IN THE COASTAL AREAS OF WATER COVERED PARTS OF MARMARA REGION IN TURKEY WITH THE HELP OF LANDSAT-4 MSS DATA USING AN UNSUPERVISED CLASSIFICATION ALGORITHM WITH EUCLIDEAN DISTANCE

D. MAKTAV (Istanbul, Technical University, Turkey) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 122-127. refs

A86-39004

USE OF THEMATIC MAPPER DATA TO ASSESS WATER QUALITY IN GREEN BAY AND CENTRAL LAKE MICHIGAN

R. G. LATHROP, JR. and T. M. LILLESAND (Wisconsin, University, Madison) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, May 1986, p. 671-680. refs
(Contract NOAA-NA-84AAD00065; NOAA PROJECT 144-U824)

N86-23027# Sandia National Labs., Albuquerque, N. Mex.

STABLE-ISOTOPE STUDIES OF GROUNDWATERS IN SOUTHEASTERN NEW MEXICO

S. J. LAMBERT 1985 23 p refs Presented at the Conference on the Rustler Formation, Carlsbad, N. Mex., 7 Mar. 1985
(Contract DE-AC04-76DP-00789)
(DE86-002590; SAND-85-1978C; CONF-8503189-1) Avail: NTIS HC A02/MF A01

Oxygen-18/16 and deuterium/hydrogen ratio measurements have been made on groundwaters sampled according to specific field criteria applied during pump tests of the Rustler Formation (the uppermost Permian evaporite unit) in Nash Draw, a solution-subsidence valley west of the WIPP site in the northern Delaware Basin of southeastern New Mexico. Comparison of these data with similar measurements on other groundwaters from the northern Delaware Basin indicates two nonoverlapping populations of meteoric groundwaters in delta-0-18/delta-D space. Most of the Rustler waters in Nash Draw and at the WIPP site and older waters from the eastern two-thirds of the Capitan Limestone constitute one population, while unconfined groundwaters originating as observable modern surface recharge to alluvium, the near-surface Rustler in southwestern Nash Draw, and the Capitan in the Guadalupe Mountains (Carlsbad Caverns) constitute the other. The isotopic distinction suggests that Rustler groundwater in most of Nash Draw and at the WIPP site is not receiving significant modern meteoric recharge. A likely explanation for this distinction is that meteoric recharge to most of the Rustler and Capitan took place in the geologic past under climate conditions significantly different from the present. DOE

N86-23993# National Oceanic and Atmospheric Administration, Washington, D. C. National Environmental Satellite, Data, and Information Service.

HYDROLOGIC AND LAND SCIENCES APPLICATIONS OF NOAA POLAR-ORBITING SATELLITE DATA

M. MATSON and F. PARMENTER-HOLT 1985 24 p refs
Original document contains color illustrations
Avail: NTIS HC A02/MF A01

Hydrologic and land sciences applications of NOAA polar orbiting satellites presented include: continental snow cover; river basin snow mapping and flood monitoring; soil moisture analysis; vegetation progress and seasonal changes; fire detection and monitoring; urban effects; volcanoes; and geologic assessment. B.G.

N86-24075 National Oceanic and Atmospheric Administration, Washington, D. C.
NOAA ATLAS: AN ATLAS OF SATELLITE-DERIVED NORTHERN HEMISPHERIC SNOW COVER FREQUENCY
M. MATSON, C. F. ROPELEWSKI, and M. S. VARNADORE Mar. 1986 149 p
Avail: NTIS HC A07/MF A01

This atlas presents 15 years (1967 to 1981) of satellite derived snow cover data in the form of monthly and midmonth to midmonth snow cover frequency maps. The maps are in two general formats: frequency of snow cover incremented in 10 percent intervals and contour maps incremented in 25 percent intervals. In addition to the maps, tables and time series of Eurasian and North American snow cover are presented. Author

N86-26665*# South Carolina Univ., Columbia. Inst. for Marine Biology and Coastal Research.
APPLICATION OF LANDSAT TM IMAGES TO ASSESS CIRCULATION AND DISPERSION IN COASTAL LAGOONS Progress Report
B. KJERFVE, J. R. JENSEN, and K. E. MAGILL 15 Feb. 1986 38 p refs
(Contract NAS5-28741)
(NASA-CR-177315; NAS 1.26:177315) Avail: NTIS HC A03/MF A01 CSCL 08C

The main objectives are formulated around a four pronged work approach, consisting of tasks related to: image processing and analysis of LANDSAT thematic mapping; numerical modeling of circulation and dispersion; hydrographic and spectral radiation field sampling/ground truth data collection; and special efforts to focus the investigation on turbid coastal/estuarine fronts. Author

N86-26668# National Environmental Satellite Service, Suitland, Md. Satellite Applications Lab.
CHARACTERISTICS OF WESTERN REGION FLASH FLOOD EVENTS IN GOES IMAGERY AND CONVENTIONAL DATA
E. L. FLEMING and L. E. SPAYD, JR. Mar. 1986 87 p refs
(NOAA-TM-NESDIS-13) Avail: NTIS HC A05/MF A01

Characteristics of western region convective and extratropical cyclone flash flood events as observed in (VIS and IR) GOES imagery and conventional surface and upper air data are presented. One hundred and thirty-seven convective heavy rainfall events from 1981 to 1983 were examined and categorized into time of year, time of day of maximum precipitation, minimum cloud top temperature at time of maximum precipitation, and type of satellite-observed convective system. Detailed analysis of conventional data for the largest flash flood producing mesoscale convective systems (MCS) yielded four distinct atmospheric patterns at the surface, 700, and 500 mb levels. Twenty-four flash flood events produced by extratropical cyclones from 1981 to 1983 were classified into three main types of satellite observed cloud patterns. These atmospheric composites and satellite observed cloud patterns were designed to aid operational meteorologists in recognizing and forecasting flash flood events in the western region of the United States. M.G.

N86-27703# National Oceanic and Atmospheric Administration, Washington, D. C.
SATELLITE-DERIVED MOISTURE PROFILES
A. TIMCHALK Apr. 1986 70 p
(NOAA-NESDIS-24) Avail: NTIS HC A04/MF A01

An evaluation of relative humidity and mixing ratio profiles determined by two different satellite methods is presented. One method (bogus), which is used operationally, uses GOES cloud imagery to prescribe vertical moisture profiles. The second method (TOVS) uses a 15-channel algorithm with polar orbiting satellite data. The accuracies of both methods, although inferior to moisture profiles obtained from rawinsondes, show sufficient accuracy to be useful as input into forecast models whose domain includes large oceanic areas. TOVS moisture profiles were more accurate in clear and partly cloudy areas, whereas the bogus profiles were more accurate in the broken cloud cover areas. An advantage of the TOVS method is that it is fully automated and can be applied globally; however, some accompanying disadvantages are that the retrievals are asynoptic and that they are made only in clear and partly cloudy areas. The major advantage of the bogus method is that profiles are available at synoptic times and over areas where no TOVS moisture values are retrieved. The disadvantage of the bogus method is that the moisture values are less accurate than the TOVS values in clear and partly cloudy areas. Furthermore, the method is only partially automated and requires subjective interpretation of cloud imagery. Author

07

DATA PROCESSING AND DISTRIBUTION SYSTEMS

Includes film processing, computer technology, satellite and aircraft hardware, and imagery.

A86-32333
IMAGE PROCESSING SYSTEM INTERFACES
W. B. GREEN (System Development Corp., Camarillo, CA) IN: Digital image processing; Proceedings of the Tenth Critical Reviews of Technology Conference, Los Angeles, CA, January 22, 23, 1985 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1985, p. 103-109.

An image processing architecture is described that provides isolation of external interfaces from image processing applications software modules. The architecture allows development of a variety of specialized user interfaces, each of which utilizes the same basic set of image processing software routines. The architecture also allows development of interfaces to external non-imaging data bases, and other software (such as commercially available Data Base Management Systems) without requiring modification of the image processing software routines. Examples of a user interface developed on a personal workstation and of the correlation of weather satellite imagery with georeferenced data bases are presented. Author

A86-32337
TECHNIQUES FOR MULTISPECTRAL IMAGE CLASSIFICATION
M. J. CARLOTTO (Analytic Sciences Corp., Reading, MA) IN: Digital image processing; Proceedings of the Tenth Critical Reviews of Technology Conference, Los Angeles, CA, January 22, 23, 1985 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1985, p. 174-191. refs

The state of the art in multispectral classifiers is reviewed by examining current multispectral techniques within the context of the overall classification process. An overview of the classification process is given, addressing such activities as scene and sensor preprocessing requirements, signal vs. semantic considerations in feature extraction, and issues relating to classifier training. Statistical classification theory is reviewed, discussing the use of spatial and contextual information, multitemporal classification techniques, hierarchical classifiers, and methods for incorporating collateral information sources to improve classification accuracy and efficiency. Post-processing techniques for extracting and interpreting spatial and structural information in the thematic map are described. Current trends in applying multispectral classification techniques are summarized, and future directions in the technology are outlined. C.D.

A86-32368

ON-BOARD DATA COMPRESSION FOR ADVANCED LANDSAT

C. SCHUELER, C. DE BOER, B. MARKS, and M. STEGALL (Hughes Santa Barbara Research Center, Goleta, CA) IN: Architectures and algorithms for digital image processing II; Proceedings of the Meeting, Los Angeles, CA, January 24, 25, 1985 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1985, p. 135-146. refs

Advanced Landsat Sensor (ALS) technology has produced requirements for increasing data rates that may exceed space to ground data link capacity, so that identification of appropriate data compression techniques is of interest. Unlike many other applications, Landsat requires information lossless compression. DPCM, interpolated DPCM, and error-correcting successive-difference PCM (ESPCM) are compared, leading to the conclusion that ESPCM is a practical, real-time (on-board) compression algorithm. ESPCM offers compression ratios approaching DPCM with no information loss and little or no increase in complexity. Moreover, adaptive ESPCM (AESPCM) yields an average compression efficiency of 84 percent relative to successive difference entropy, and 97 percent relative to scene entropy. Compression ratios vary from a low of 1.18 for a high entropy (6.64 bits/pixel) mountain scene to a high of 2.38 for low entropy (2.54 bits/pixel) ocean data. The weighted average lossless compression ratio to be expected, using a representative selection of Landsat Thematic Mapper eight-bit data as a basis, appears to be approximately 2.1, for an average compressed data rate of about 3.7 bits/pixel. Author

A86-32370

IMAGE SEGMENTATION ALGORITHMS

T. W. RYAN (Science Applications International Corp., Tucson, AZ) IN: Architectures and algorithms for digital image processing II; Proceedings of the Meeting, Los Angeles, CA, January 24, 25, 1985 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1985, p. 172-178. refs

The paper describes a sequence of algorithms used to perform segmentation of aerial images of natural terrain for the purpose of extracting features pertinent to cartographic applications. Topics include image filtering, labeling, automated editing and refinement of the segmentation within a resolution pyramid. These techniques are considered to be preprocessing activities which will, in general, require some editing by trained cartographers. The objective of this work is to minimize the tedium of feature extraction using algorithms that do not require excessive computational overhead. Author

A86-32688

A HISTOGRAM AS THE BASIS OF THE STATISTICAL CLASSIFICATION OF IMAGES [GISTOGRAMMA KAK OSNOVA STATISTICHESKOI KLASSIFIKATSII IZOBRAZHENII]

D. A. USIKOV and T. V. PIATIBRAT (AN SSSR, Institut Kosmicheskikh Issledovanii, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1986, p. 99-103. In Russian. refs

The concept of statistical image classification (as applied to remote-sensing images, e.g., in crop monitoring, forest inventory, and geological survey) is defined. In this classification, a histogram can have a fundamental role as a complete system of functionals expressing all the other statistical characteristics of the images. Histogram-based procedures for calculating Mahalanobis distances are proposed. B.J.

A86-33515

PRELIMINARY ANALYSIS OF SIR-B IMAGES FOR STEREO APPLICATIONS

V. H. KAUPP, H. C. MACDONALD, W. P. WAITE (Arkansas, University, Fayetteville), and M. A. PISARUCK (Boeing Airplane Co., Seattle, WA) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 105-110. refs

Space Shuttle Imaging Radar (SIR-B) SAR images of a single region in South America that were obtained at several different illumination angles have been evaluated to determine the illumination angle combination that best generates a three-dimensional stereo model of a terrain type for human perception. After such parameters as resolution and image scale are taken into account, rankings obtained with the images are found to compare favorably with earlier analyses and with the model of an equation here presented. O.C.

A86-33522

LITHOLOGIC SIGNATURES IN MULTI-CHANNEL SAR IMAGERY

B. A. BURNS, K. I. BARTELS, and R. W. LARSON (Michigan, Environmental Research Institute, Ann Arbor) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 153-157. refs

(Contract NSF ECS-82-13418)

Dual polarization, dual frequency SAR data of semiarid terrain in north-central Arizona is found to provide good discrimination between a variety of volcanic and sedimentary units in the area. These data allow not only manipulation of multichannel composite images to enhance scattering differences between units, but also derivation of radiometrically rectified relative backscatter cross sections. Based on these cross section values, dielectric constant measurements of field samples, and surface roughness profiles, the relative importance of surface and volume scattering for the different units are evaluated. Three-color composite images revealed that the 23-cm L-band wave is sensitive to unit contacts, producing high contrast for forested areas and rivers banks, and that the 3-cm X-band wavelength picks up more of the textural details in the units. Experimental results indicate that for two surfaces of similar roughness, differences in dielectric constant alone are sufficient to explain the observed X-band signatures. R.R.

A86-33526

DESCRIPTION OF A DATABANK OF NORMALIZED RADAR CROSS SECTION OF TERRAIN

C. C. BOREL, R. M. NARAYANAN, and R. E. MCINTOSH (Massachusetts, University, Amherst) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 176-182.

(Contract F19628-84-K-0018)

A computer program called FINRACS which allows users access to published NRCS data on a variety of terrain conditions is described. The rationale, terrain classification system, and main features of the program are described with examples. Possible applications of the databank are also indicated. Author

A86-33534
AUTOMATIC CLOUD CLASSIFICATION
B. M. MEHTRE, N. N. MURTHY (CMC, Ltd., Secunderabad, India), B. LIPOVSCAK (Hidrometeoroloski Zavod SR Hrvatske, Zagreb, Yugoslavia), and B. CHATTERJEE (Indian Institute of Technology, Kharagpur, India) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 233-241. refs

In this paper design and implementation of an automatic cloud classifier is discussed. It is assumed that the pattern classes obey the multivariate normal distribution. Maximum likelihood with threshold and penalized misclassification algorithms have been implemented both on host computer VAX-11/750 and Array Processor FPS/100. This technique classifies not only different cloud types but land, sea and snow as well. The result of classification and the time required on host as well as on array processor for various picture complexities has been tested. The array processor results are found to approach real time performance. NOAA satellite pictures have been used for testing. Author

A86-33535
CONTEXT CLASSIFIER
R. M. HARALICK and H. JOO (Machine Vision International, Ann Arbor, MI) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 247-254.

A pixel can have certain properties when viewed in isolation, which change when viewed in the entire context of the image. A theory, and an algorithm are presented for a context classifier which gives each pixel the highest probability label, given some substantially sized context neighboring the pixel. The algorithm takes the form of a recursive neighborhood operator, first applied in a top-down scan of the image, and then in a bottom-up scan of the image. Applied to a simulated image generated from a real Landsat image, the context classifier showed better accuracy than the Bayes classifier. On real images, the contex classifier showed a 4 to 8 percent increase in overall classification accuracy over the context-free Bayes classsifier under a Gaussian-distribution assumption. I.S.

A86-33594* National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
MULTIPOLARIZATION SAR DATA FOR SURFACE FEATURE DELINEATION
S. T. WU (NASA, National Space Technology Laboratories, Bay St. Louis, MS) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 678-683. refs

This paper presents the techniques and the utility of multipolarization Synthetic Aperture Radar (SAR) data for surface feature delineation. Three channels of ratioed data (VV/HH, VH/HH, and VH/VV) are generated from the HH, VV, and VH polarization data (V = vertical, H = horizontal). The technique assumes redundancy of the VH and HV polarization and only VH polarization is used. The ratioed data are linearly stretched to yield a digital number within a range of 0 to 255. Based on the separability measure for two-class delineation, it was found that (1) the ratioed data resulted in a better delineation of surface features with high like (HH or VV) polarization digital number, and (2) the use of ratioed data provided further information not available from the original three-polarization data. The results suggest an advantage in using the ratioed data and the original three-polarization data for surface feature delineation. Author

A86-33596* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE DEVELOPMENT OF AN MSS SATELLITE IMAGERY CLASSIFICATION EXPERT SYSTEM
S. W. ENGLE (NASA, Ames Research Center; Informatics General Corp., Moffett Field, CA) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 693-696.

Unsupervised image classification of Landsat MSS imagery entails a significant part of the remote sensing, image analysis effort. Expert systems, a technology developed in the field of artificial intelligence, offers the potential to automate this process, thus greatly increasing the efficiency with which an analyst can perform unsupervised image classification and making the knowledge of the image analyst available to a community of nonexperts. Such a system, under development at the NASA/Ames Research Center, is described and planned enhancements are discussed. Author

A86-33597
A STEPWISE HIERARCHICAL MULTI-BINARY APPROACH IN TM LANDUSE CLASSIFICATION
K. I. ITTEN, K. STAENZ, M. F. BAUMGARTNER, and TH. JOHNSON (Zuerich, Universitaet, Zurich, Switzerland) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 697-702. refs

In Thematic Mapper landuse classification, a stepwise procedure is suggested as an alternative to the usual practice of classifying the total scene content in one expensive swath. Binary decisions in a hierarchically structured model lead to the degree of separation and classification level that is predefined by the customer and that can be obtained, so control is not lost in a multidimensional, multiproblem compromise. Thematic Mapper data will not completely solve all classification problems, but even with a medium technology approach it permits landuse classifications better than any previous sensor. D.H.

A86-33600
SLOPE-INTERCEPT-DENSITY PLOTS - A NEW METHOD FOR LINE DETECTION IN IMAGES
F. SALVINI (Pisa, Universita, Italy) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 715-720.

A new approach to the problem of line detection is announced, going back to the first principles of lines to define slopes and intercepts with the X or Y axes. Most plotting and calculations are then done in slope-intercept space in which a line is represented as a point and a line in slope-intercept space represents all possible lines passing through a point in XY space. If a pixel has something distinctive about it that might help to define a line in the image, then all possible lines through that pixel can be represented by a line in slope-intercept space. In this way a grid can be prepared representing all possible lines through all distinctive pixels in the image. The number of calculations required increases approximately linearly with the number of pixels, rather than exponentially as with other methods. If the size or shape of the counting circle is allowed to vary, the sharpness of the detected lines can be made greater or less. D.H.

A86-33621

A NON-STATIONARY CONTEXTUAL CLASSIFIER WITH IMPROVED ACCURACY

J. K. RHO and K. H. PARK (Korea Advanced Institute of Science and Technology, Seoul, Republic of Korea) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 886-891.

A modified contextual classifier - called a nonstationary contextual classifier - is proposed. In the new method, the context distribution function is considered as the context probability. It is shown by real Landsat II data for the Seoul area and simulated data that the method offers substantial improvement in classification accuracy. Results are comapred with a classify-and-count contextual classifier and the Bayes classifier. As the raw speed of computer components improve, it is expected that the proposed classifier will be useful in various applications where classification accuracy is very important. D.H.

A86-33624* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

LAND USE MAPPING USING EDGE DENSITY TEXTURE MEASURES ON THEMATIC MAPPER SIMULATOR DATA

C. A. HLAVKA (NASA, Ames Research Center, Moffett Field, CA) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 906-911. refs

Texture analysis was performed as part of an investigation of the information content of Thematic Mapper (TM) imagery. High altitude aircraft scanner imagery from the Airborne Thematic Mapper (ATM) instrument was acquired over central California and used to simulate TM data. Edge density texture images were constructed by computation of proportions of edge pixels in a 31 x 31 moving window on a near infrared ATM band. A training technique was employed to select computational parameters to maximize the difference between edge density measurements in urban and in rural areas. The results of classification of the texture images showed that urban and rural areas could be distinguished with texture alone, indicating that inclusion of texture in automated classification procedures could significantly improve their accuracy. Author

A86-33626

CLASSIFICATION OF GEOPHYSICAL PARAMETERS USING PASSIVE MICROWAVE SATELLITE MEASUREMENTS

R. R. FERRARO, JR., J. A. KOGUT (Research and Data Systems, Inc., Lanham, MD), and N. C. GRODY (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 919-924. refs

A method using the 18 and 37 GHz vertically polarized brightness temperatures from the Nimbus-7 Scanning Multichannel Microwave Radiometer (SMMR) to classify six different geophysical parameters is presented. These parameters are: dry snow, sea ice, dry land, flooded land, precipitation, and open water. The microwave theory and classification algorithm are briefly discussed, and the method is illustrated with an example. C.D.

A86-33638* Boston Univ., Mass.

VARIOGRAMS AND SPATIAL VARIATION IN REMOTELY SENSED IMAGES

C. WOODCOCK (Boston University, MA) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 1078-1083. NASA-supported research.

Research is presented that is aimed at developing a link or connection between ground scenes and spatial variation in images. The link is established through the use of models of scenes and a measure of spatial variation - the variogram. The approach used to explore the nature of spatial variation in remotely sensed images can be thought of as a 'bottom up' approach because it starts with a model of the scene and works toward the characteristics of a remotely sensed image derived from the scene. To date, observed images at two resolutions for each of three kinds of environment have been used to evaluate the use of variograms in real images. The images are from forests, residential, and agricultural environments. One resolution used is 30 m from the Thematic Mapper or Thematic Mapper Simulator. For each environment also there is fine resolution data from the range of 0.15-2.5 m. It is noted that variograms from these images show considerable structure. Work continues on checking the validity of the disk model (a way of representing trees and their shadows). D.H.

A86-33639

SPATIAL ENHANCEMENT TECHNIQUES FOR MULTICHANNEL SATELLITE IMAGERY

V. T. TOM and M. J. CARLOTTO (Analytic Sciences Corp., Reading, MA) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 1084-1090.

Global and local multiband spatial enhancement techniques for digital imagery are described. The techniques are based on a least-squares approach, and utilize correlation between a low resolution image of one spectral wavelength and a high resolution reference image of a different wavelength in order to augment the high spatial frequency content of the low resolution image. The limitations of the global approach motivate a local approach based on a sliding window technique. Using the local enhancement approach, the apparent ground resolution for TM thermal imagery and SPOT multispectral imagery is improved from 120 to 30 meters and 20 to 10 meters, respectively. Author

A86-33640* Du Pont de Nemours (E. I.) and Co., Wilmington, Del.

MODIFIED CUBIC CONVOLUTION RESAMPLING FOR LANDSAT

A. PRAKASH (Du Pont de Nemours and Co., Wilmington, DE) and B. MCKEE (General Electric Co., Philadelphia, PA) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 1091-1096.
(Contract NAS5-25300)

An overview is given of Landsat Thematic Mapper resampling technique, including a modification of the well-known cubic convolution interpolator (nearest neighbor interpolation) used to provide geometric correction for TM data. Post launch study has shown that the modified cubic convolution interpolator can selectively enhance or suppress frequency bands in the output image. This selectivity is demonstrated on TM Band 3 imagery. D.H.

A86-34738

THE ESTIMATION OF ATMOSPHERIC EFFECTS FOR SPOT USING AVHRR CHANNEL-1 DATA

S. M. SINGH and A. P. CRACKNELL (Dundee, University, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, March 1986, p. 361-377. Sponsorship: Ministry of Defence. refs
(Contract MOD-2205/24S)

The aim of this paper is to estimate the effect of atmospheric contamination on SPOT satellite data for stereoscopic modelling by using data from the AVHRR instrument carried on the NOAA satellite series. This paper includes the development of an atmospheric correction algorithm for the visible spectral channel data from the AVHRR instrument, and an analysis of the atmospherically corrected AVHRR data from many successive days, bearing in mind that the SPOT data for stereoscopic modelling will be from two orbits which will be separated by several days. Author

A86-34739
THE APPLICABILITY OF LOWTRAN 5 COMPUTER CODE TO AERIAL THERMOGRAPHIC DATA CORRECTION
S. B. WILSON and J. M. ANDERSON (Dundee, University, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, March 1986, p. 379-386. refs

The data available in the LOWTRAN 5 computer code are applied to short path lengths for radiation in the thermal infrared range during a particular survey. The resulting calculated value for the atmospheric transmittance is compared with an experimentally derived value. Author

A86-35111
PROBLEMS WITH GLOBAL MAPPING
K. RAWER (Freiburg, Universitaet, Freiburg im Breisgau, West Germany) Acta Astronautica (ISSN 0094-5765), vol. 13, March 1986, p. 131, 132. refs

The empirical arid orthogonal functions mapping techniques are described. The incorrect mapping characteristics obtained with these techniques and various methods of correcting these problems are examined. The relationship between coordinates and the mapping procedures is studied. Various examples of global mapping by empirical and orthogonal functions methods are provided. I.F.

A86-35292
EXAMPLES OF THE AUTOMATED DERIVATION OF DIGITAL SURFACE MODELS [BEISPIELE ZUR AUTOMATISCHEN ERFASSUNG VON DIGITALEN OBERFLAECHENMODELLEN]
W. FOERSTNER (Stuttgart, Universitaet, West Germany) Bildmessung und Luftbildwesen (ISSN 0006-2421), vol. 54, March 1986, p. 71-79. In German. refs

The power and heterogeneity of existing approaches to the automated derivation of digital surface models are shown using three examples of feature-based stereo matching algorithms. The automated measurement of digital suface models is discussed, examining criteria for the selection of control points, suitable features for surface measurement, and available information suitable for interpolation. C.D.

A86-36079
SATELLITE ORIENTATION AND POSITION FOR GEOMETRIC CORRECTION OF SCANNER IMAGERY
P. H. SALAMONOWICZ (USGS, Reston, VA) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, April 1986, p. 491-499. refs

The U.S. Geological Survey (USGS) Mini Image Processing System currently relies on a polynomial method for geometric correction of Landsat multispectral scanner (MSS) data. A large number of ground control points are required because polynomials do not model the sources of error. In order to reduce the number of necessary points, a set of mathematical equations modeling the Landsat satellite motions and MSS scanner has been derived and programmed. A best fit to the equations is obtained by using a least-squares technique that permits computation of the satellite orientation and position parameters based on only a few control points. The parameters thus derived serve as a basis for geometric correction of the whole image. A preliminary test shows that the model permits pixel location to be predicted to approximately 100 meters based on six control points. Author

A86-36082
ECONOMICAL MAINTENANCE OF A NATIONAL TOPOGRAPHIC DATA BASE USING LANDSAT IMAGES
A. F. GREGORY and H. D. MOORE (Gregory Geoscience, Ltd., Ottawa, Canada) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, April 1986, p. 519-524. refs

An operational program to detect changes for 1:50,000 mapping and to provide information for the revision of 1:250,000 maps has been developed and implemented. A specialized projection-compositor (PROCOM-2) is used to register a recent Landsat MSS image onto a 1:50,000 topographic map. Experience to date indicates that the average relative error in positioning of linear features is about 30 m at a scale of 1:50,000. A recent program of 2700 maps, representing an area of about 2 million sq km, was completed in nine months including selected field verification. The average cost for this combined program of change detection and map revision was $0.15 (U.S.) per sq km or $150 (U.S.) per 1:50,000 map. Relevent experience suggests that these techniques can be transferred with minimal training and capital cost for use in other parts of the world; some modification may be required for arid areas and rainforest. Author

A86-36227#
INTRASEASONAL VARIATIONS OF OLR IN THE TROPICS DURING THE FGGE YEAR
T. NAKAZAWA (Meteorological Research Institute, Tsukuba, Japan) Meteorological Society of Japan, Journal (ISSN 0026-1165), vol. 64, Feb. 1986, p. 17-34. refs

NOAA satellite data collected during the FGGE experiment are analyzed to model the seasonal characteristics of thef intraseasonal variations and the relationship with shorter period fluctuations and tropical cyclone activities in the Northern and Southern Hemisphere tropics. The satellite data encompassed twice-daily outgoing longwave radiation (OLR), a measure of the convective activity over the tropics. A harmonic analysis with a least squares approach was applied to 11 months of data to study the annual mean, yearly and half-yearly cycles, as well as any periodicity in 3-10 day periods. The latter periods exhibited amplitude modulations that had a 30-60 day period. The short-period fluctuations had amplitudes that were large during the active phase of the intraseasonal variations and small during the lapse in the variations. The data only covered a period of 11 months and need to be supplemented with data from several more years to test the validity of the observed relationships. M.S.K.

A86-36511
TECHNICAL AND SOFTWARE FACILITIES AT A CENTER FOR THE PROCESSING OF REMOTE-SENSING DATA [TEKHNICHESKOE I PROGRAMMNOE OBESPECHENIE TSENTRA OBRABOTKI AEROKOSMICHESKOI INFORMATSII]
A. S. ALEKSEEV, S. T. VASKOV, V. N. DEMENTEV, B. K. KOZHEVNIKOV, E. G. MIKHALTSOV et al. IN: Methods of combined air and space remote-sensing studies of Siberia . Novosibirsk, Izdatel'stvo Nauka, 1985, p. 57-60. In Russian.

The structure of technical and software facilities at TsOGI, the Soviet center for the processing of remote-sensing data, is examined. Particular attention is given to: (1) the main tasks toward which the technical facilities are oriented; and (2) the multilevel organization of the software system for image processing. The user-oriented character of the center is emphasized, and prospects for the further development of the facilities are discussed. B.J.

A86-36515
STATISTICAL APPROACH TO THE CLASSIFICATION OF OBJECTS ON AIR AND SPACE REMOTE-SENSING IMAGES [STATISTICHESKII PODKHOD K KLASSIFIKATSII OB'EKTOV NA AEROKOSMICHESKIKH IZOBRAZHENIIAKH]
B. A. GORBUNOV IN: Methods of combined air and space remote-sensing studies of Siberia . Novosibirsk, Izdatel'stvo Nauka, 1985, p. 75-79. In Russian.

A86-36517
CERTAIN TRANSFORMATIONS IN A QUANTITATIVE APPROACH TO IMAGE PROCESSING [NEKOTORYE PREOBRAZOVANIIA V KOLICHESTVENNOM PODKHODE PRI OBRABOTKE IZOBRAZHENII]
V. A. ZABELIN and V. P. PIATKIN IN: Methods of combined air and space remote-sensing studies of Siberia . Novosibirsk, Izdatel'stvo Nauka, 1985, p. 84-87. In Russian. refs

A quantitative image-synthesis approach for remote-sensing images is examined. The development of quantitative methods for the processing of spectrally superposed data is considered with emphasis on the choice of spectral band for the image synthesis. B.J.

A86-36518

COMPUTER PROCESSING OF SPECTRALLY SUPERPOSED DATA [OBRABOTKA SPEKTROSOVMESHCHENNOI INFORMATSII NA EVM]

V. A. ZABELIN IN: Methods of combined air and space remote-sensing studies of Siberia . Novosibirsk, Izdatel'stvo Nauka, 1985, p. 87-90. In Russian. refs

An interactive technique for the processing of multispectral remote-sensing data is described. Particular attention is given to the subprograms in the appropriate software package, intended for the processing of spectrally superposed data. B.J.

A86-36794

ESTIMATION OF ATMOSPHERIC CORRECTIONS FROM MULTIPLE AIRCRAFT IMAGERY

M. D. STEVEN and E. M. ROLLIN (Nottingham University, England) (Workshop on Atmospheric Corrections, University of Nottingham, England, May 22, 1985) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, April 1986, p. 481-497. NERC-supported research. refs

Remote-sensing techniques measure the radiance of the surface through a layer of atmosphere which both attenuates the signal and adds a path radiance. One class of solution can be found using the known dependence of transmittance on atmospheric path length. Multiheight measurements from aircraft enable the determination of transmittance and path radiance by linear regression. Multiangle measurements from overlapping aircraft scans have also been applied, but the difference of path lengths offered by the range of aircraft scan angles is insufficient to determine the atmospheric parameters with accuracy, especially with the uncertainties introduced by reflection from non-Lambertian surfaces. The atmosphere is not horizontally homogeneous in the presence of cloud or dense haze. Significant variations occur even at a distance from clouds and, on cloudless days, variations in optical depth can occur in dense haze layers. The variations are most significant at shorter wavelengths but have a coherent spatial distribution which can be applied to distinguish zones of different atmospheric characteristics. Author

A86-36790

LANDSAT TM IMAGE FORWARD/REVERSE SCAN BANDING CHARACTERIZATION AND CORRECTION

L. FUSCO, U. FREI, D. TREVESE (ESA, European Space Research Institute, Frascati, Italy), P. N. BLONDA, G. PASQUARIELLO (CNR, Istituto Elaborazione Segnali ed Immagini, Bari, Italy) et al. International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, April 1986, p. 557-575. refs

Cross-scan averages of forward and reverse scan are analysed to model the within-line sample-position-dependent noise of Landsat Thematic Mapper images, in cases where no radiometric saturation is present. Two sources of banding are discussed: the droop, already mentioned by other authors, and the so-called radiometric hysteresis. The defined models are used to generate a correction algorithm which has been tested with real data. Author

A86-37003

HIGH ACCURACY CLUSTERING USING RESIDUAL IMAGE

K. FUKUE, H. SHIMODA, and T. SAKATA (Tokai University, Tokyo, Japan) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 17-25.

The minimum residual clustering procedures used to classify remote sensing data is described. Training data problems, which include the number of training classes and training data, and the effect of subclasses on training classes, are examined. Two simulations were conducted in order to evaluate the characteristics of the minimum residual clustering. The applicability of the minimum residual clustering is examined in two case studies: one case is the land cover classification of the Osaka district and the second is the forest classification of the Mount Fuji area using Landsat MSS data. The data reveal that the minimum residual clustering has a higher classification accuracy and a shorter processing time than conventional clustering procedures. I.F.

A86-37004

MULTISPECTRAL CHANGE DETECTION USING DIFFERENCE CLASSIFICATION AND BITEMPORAL CLASSIFICATION

G. M. HALEY (Santa Barbara Research Center, CA) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 26-33.

The development of a boundary change detection technique is discussed. The technique is applicable for agriculture, building construction, military surveillance, and glacier movement observations. The gradient methods for boundary indications and the global histogram and region growing classification techniques are examined. The procedures for two methods of boundary change detection are described and compared in terms of accuracy and computational requirements. One method uses gradient operators and difference classifications to observe spectral changes and the second technique employs bitemporal classification to detect spatial variations. It is noted that the second technique is more accurate than the first; however, it requires more computational time. Author

A86-37006

ESTIMATION OF THE LOCATION PARAMETER OF A MULTISPECTRAL DISTRIBUTION BY A MEDIAN OPERATOR

C. A. POMALAZA-RAEZ and Y.-S. FONG (Clarkson University, Potsdam, NY) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 41-48. refs

Three different kinds of median type estimators for use in applications where the underlying probability distribution is multivariable are proposed and analyzed. Such applications arise in the area of remote sensing classification, problems, multispectral edges filtering, and computer vision systems. Both aspects, the numerical complexity, and the statistical characteristics of the estimators are studied and discussed. From the numerical results obtained by analytical and computer simulation methods there is evidence that a simple extension of the scalar median estimator has an overall performance (in the mean square error sense) that is the same or better than the other two proposed estimators. The computational requirements of this estimator are not excessive making it attractive for applications where large amounts of data are present. Author

A86-37017

HIERARCHICAL CLASSIFICATION OF MULTITEMPORAL/MULTI-SPECTRAL SCANNER DATA

D. F. LOZANO-GARCIA and R. M. HOFFER (Purdue University, West Lafayette, IN) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 162-169. refs

To evaluate the classification accuracy of hierarchical classifiers, the results obtained by the use of the layered hierarchical classifier were compared to those of a single stage classifier, using Landsat-1 MSS data obtained in June 1973 and February 1974 over two central Indiana areas. Four procedures were used: (1) a standard single stage maximum likelihood classification employing an eight-channel training statistics, and (4) the layered classifier, but treating the data from the two dates independently. It has been found that the classification accuracies were relatively high for all four procedures, but that the layered classifier was more efficient, requiring only one third of the CPU time used in the single stage classification. I.S.

A86-37019

PROCESSING OF MULTI-SENSOR REMOTELY SENSED DATA TO A STANDARD GEOCODED FORMAT

T. A. FISHER (Canada Centre for Remote Sensing, Ottawa) and N. MINIELLY (MacDonald Dettwiler and Associates, Ltd., Vancouver, Canada) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 183-188.

To realize the full potential of remotely sensed data, it must be corrected and converted to a standard format. The Canada Centre for Remote Sensing (CCRS) has defined a standard geocoded format (Guertin et al.) which is compatible with the Canadian National Topographic System (NTS) series of maps. This paper gives the characteristics of the CCRS geocoded products, describes some of the benefits that will be derived from the application of geocoded products, and gives a brief overview of the Multi-Observational Satellite Image Correction System (MOSAICS) which is being developed to create these products. MOSAICS will correct and convert imagery from a number of different satellites and sensors into CCRS geocoded format, producing a large number of high accuracy CCT and film products. Author

A86-37022

MULTISOURCE DATA ANALYSIS IN REMOTE SENSING AND GEOGRAPHIC INFORMATION PROCESSING

P. H. SWAIN (Purdue University, West Lafayette, IN), J. A. RICHARDS, and T. LEE (New South Wales, University, Kensington, Australia) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 211-218.
(Contract NSF ECS-84-00324)

A general approach is presented for the computer analysis, using quantitative multivariate methods, of remote sensing data combined with other sources of data in geographic information systems. A method is proposed by which inferences can be drawn systematically from multiple observations having significant but unknown interactions. A simple classification experiment with Landsat MSS data is undertaken to illustrate the use of this method. Author

A86-37026

RADAR IMAGE SIMULATION AS A TOOL TO ANALYZE TOPOGRAPHIC EFFECTS ON GEOMETRY AND RADIOMETRY OF RADAR IMAGERY

G. DOMIK (Graz, Technische Universitaet und Forschungszentrum, Austria) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 248-253. refs
(Contract ESA-5443/83/D/IM(SC))

Radar image simulation was used to create a relationship between radar image coordinates and corresponding terrain properties as a means of analyzing radar radiometry and geometry. Using a digital elevation model, and flight and image parameters extracted from SIR-A data of Sardegna collected in November 1981, the simulator models all geometric aspects of the SIR-A sensor, and the image is then registered and geometrically rectified to yield a radar ortho image of the digital terrain model geometry. Radiometric correction of the radar image, removing the effects of topographic slopes, enabled lithological mapping, and for the given example, two thematic classes were differentiated. An additional simulation study indicated that the loss of image information due to layover, foreshortening and radar shadow would be minimized using an elevation angle as high as 60 degrees at the average Space Shuttle altitude of 260 km. R.R.

A86-37027* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

PRELIMINARY SCIENCE RESULTS FROM THE SHUTTLE IMAGING RADAR-B

M. RUZEK (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 254-265. NASA-supported research. refs

Preliminary results of analyzing digital radar imagery data obtained by the SIR-B aboard the Space Shuttle Challenger STS 41-G are presented. The data cover 5 million square kilometers of the earth surface between 57 deg north and south latitudes. Radar imagery of the same target at different incidence angles was used to classify surfaces by their backscatter response as a function of incidence angle. The SIR-B proved to be useful for collecting multiple incidence angle data sets over a broad range of targets, providing information in the areas of geology, archeology, forestry, agriculture, oceanography, geography, and hydrology. The analysis is also used to optimize radar parameters such as look angle for future missions. I.S.

A86-37028* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

THE SIR-C EXPERIMENT - MEASURING NEW VARIABLES FROM SPACE WITH SAR

S. D. WALL (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 268-270. NASA-supported research.

SIR-C is a continuation of the Shuttle Imaging Radar (SIR) series of synthetic aperture radar (SAR) imaging systems flown by the Jet Propulsion Laboratory aboard the Space Shuttle. SIR-A, flown in 1981, showed that SAR can be a useful remote sensing tool in the fields of geology, hydrology, and oceanography. SIR-B added the capability of moving the radar's antenna in 1984, showing that multiple incidence angle images add materially to the usefulness of SAR. SIR-C will add the dimensions of wavelength and polarization, providing the most powerful system ever flown for SAR scientific studies of the earth. Author

A86-37032* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

MEASUREMENT OF THEMATIC MAPPER DATA QUALITY

R. C. WRIGLEY, C. A. HLAVKA, D. H. CARD (NASA, Ames Research Center, Moffett Field, CA), J. S. BUIS (Technicolor Government Services, Inc., Moffett Field, CA), R. A. SCHOWENGERDT (Arizona, University, Tucson) et al. IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 303-314. refs

Thematic Mapper data from Landsat-4 and Landsat-5 were examined for band-to-band registration, absolute geodetic registration, periodic noise and spatial resolution. Between focal planes, appreciable misregistrations existed in early data products but were corrected in later data products. The analysis of absolute geodetic registration used only system-corrected data because ground control point-corrected data were unavailable. Geodetic registration errors averaged only 9.7 pixels, less than expected for system-corrected data. Periodic noise at four spatial frequencies was observed in Landsat-5 Thematic Mapper data by using Fourier analysis on small areas over water. Magnitudes of periodic noise components were consistent within a scene. The modulation transfer function was determined for two Landsat-4 scenes. The effective instantaneous field of view was 40.8 meters in one case, and 48.6 meters in the other. Author

A86-37033

A CLUSTERING ALGORITHM FOR REMOTE SENSING MULTISPECTRAL DATA

L. I. DAWEI (Zhanjiang Electronic Industrial Co., People's Republic of China) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 315-318. refs

A clustering algorithm, named SORT, used for classification of remote sensing multispectral data is described. The program involves the scanning of the entire image and the construction of a cluster table. The SORT program operates in the IRAS II image processing system and is applicable for geoscience studies. I.F.

A86-37864#

DESIGN OF THE EUROPEAN SPACE AGENCY THEMATIC MAPPER PROCESSING CHAINS

G. TREVISIOL (Advanced Computer Systems, Italy) IN: International Conference on Space, 25th, Rome, Italy, March 26-28, 1985, Proceedings . Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1985, p. 207-215.

A data processing system is described that is designed to process the data acquired from Landsats 4 and 5 (Multispectral Scanner and Thematic Mapper data) and SPOT (HVR1 and HVR2 data). The data are received by the SSX Acquisition System and recorded on a high density digital recorder during a satellite pass. User products, or output products, are available as images stored on computer compatible tapes (CCT) and as images stored on film. The processing subsystem provides quick-look images on CCT or film and raw/system-corrected images on CCT or 240-mm film. The data management subsystem provides for automatic order handling of output products, monitoring of the production process, and management of the Image Catalogue. Design criteria and hardware and software subsystem overviews are discussed. The project was completely successful. D.H.

A86-39150

APPLICATION OF SHUTTLE IMAGING RADAR DATA FOR LAND USE INVESTIGATIONS

J. LIU (Chinese Academy of Sciences, Institute of Remote Sensing Application, Beijing, People's Republic of China), X. TENG (Chinese Academy of Sciences, Changchun Physics Institute, People's Republic of China), and J. XIAO (Chinese Academy of Sciences, Institute of Geochemistry, Guiyang, People's Republic of China) Remote Sensing of Environment (ISSN 0034-4257), vol. 19, June 1986, p. 291-301.

A Shuttle Imaging Radar (SIR)-A image in the south of Tianijin acquired by the SIR-A in November 1981 was interpreted manually and with the aid of a computer system. The methods of processing involved density slicing with statistical training, producing normalized false color composite images through coregistration of the SIR-A and Landsat MSS image data sets, and unsupervised clustering. The interpretation keys for the SIR-A image were established after investigation in situ and analysis of soil dielectric and moisture properties. The interpretation accuracy for various images were determined by using a combination of color infrared and aerial photography and land use maps acquired recently. The research indicates that the SIR-A data can remedy some defects of Landsat MSS data due to the SIR-A's better response to residential areas and linear features. The SIR-A/Landsat MSS normalized composite image incorporated the strong points of both. The interpretation accuracy, therefore was increased. Author

A86-39545

A TECHNIQUE FOR ASSESSING THE SEVERITY OF TERRAIN SHADOWING IN MOBILE SATELLITE SERVICE

A. HILLS (Alaska, University, Fairbanks) and D. C. ROGERS (Chugach Electric Association, Anchorage, AK) IEEE Transactions on Antennas and Propagation (ISSN 0018-926X), vol. AP-34, April 1986, p. 601-603.

A graphical analysis technique is presented that produces an estimate of the severity of terrain shadowing of a particular geosynchronous satellite. The technique can be used to analyze the coverage provided by a new group of satellites capable of direct communication with mobile and transportable units. Application of the technique to a number of highways in Alaska is described. Author

N86-23028# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.

MAP DIGITIZATION OFFERS NEW POSSIBILITIES

F. A. GERRITSEN and H. J. BOS 6 Aug. 1984 13 p Repr. from De Ingenieur (Utrecht, Netherlands), v. 96, no. 94, Apr. 1984 p 26-29 In DUTCH; ENGLISH summary Presented at Royal Netherlands Institute of Engineering (KLvL) Digital Maps Symposium, The Hague, Netherlands, 8 Feb. 1984 Original contains color illustrations
(NLR-MP-84061-U; B8571449) Avail: NTIS HC A02/MF A01

Alternatives for the digitization of map information, its application possibilities, costs, and required efforts are discussed. Structured geographic data bases for map production offer a large range or possibilities, but require large personnel efforts. Simple interactive use for presentation purposes demands a less complicated way of digitization, but requires relatively expensive apparatus. An automated system for flight route planning is mentioned. Author (ESA)

N86-25919# National Geophysical Data Center, Boulder, Colo.

EARTHQUAKE AND TSUNAMI DATA SERVICES AND PUBLICATIONS

Dec. 1985 15 p
(PB86-156254; KGRD-15-REV) Avail: NTIS HC A02/MF A01 CSCL 08G

The National Environmental Satellite, Data, and Information Service (NESDIS) collects, manages, and diseminates the great mass of information produced by the scientific observation of interplanetary space and the physical world. Data activities in seismology, gravity, geomagnetism, marine geology and geophysics, geothermics, and solar-terrestrial physics are directed by the NESDIA National Geophysical Data Center (NGDC) in Boulder, CO. NGDC also provides facilities for World Data Center-A (including the disciplines of Solid Earth Geophysics, Marine Geology and Geophysics, Solar-Terrestrial Physcis, and Glaciology). The products and services in seismology are briefly described. NGDC is a focal point for disseminating historical earthquake data and information to both technical and general users. Author

N86-27749*# Colorado Univ., Boulder. Dept. of Astrophysics, Planentary and Atmospheric Science.

TRANSIENT RESPONSE TO LOCALIZED EPISODIC HEATING IN THE TROPICS

M. L. SALBY and R. R. GARCIA (National Center for Atmospheric Research, Boulder, Colo.) *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 8 p Dec. 1985
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

It is generally recognized that equatorial disturbances in the lower stratosphere are excited by convective latent heat release associated with the Internal Tropical Convergence Zone (ITCZ). Recently, attention has also focused on tropical convection with regard to extratropical teleconnection patterns. Unlike equatorial waves which are trapped about the equator but propagate vertically, the latter extend well out of the tropics but are barotropic. They have been most widely discussed in connection with long-term climatological features. Both types of disturbances have been examined largely from the standpoint of steady monochromatic forcing, in the latter case zero frequency or time-mean heating. However, tropical convection as revealed by recent geostationary satellite imagery is anything but regular, surely not steady. Much of the heating variance is concentrated spatially within three localized convective centers: Indonesia, the Amazon, and the Congo. Convective activity within these regions undergoes an irregular evolution over the span of a couple of days. It involves a rather broad spectrum of spatial and temporal scales. The analysis of cloud brightness over the Eastern Atlantic and Africa suggests a characteristic time scale of 3-4 days and correlations scales in latitude and longitude of approximately 30 deg. Author

08

INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A86-31222
SPOT - A HIGH-PRECISION VIEW OF THE EARTH
S. COMPARD Revue Aerospatiale (ISSN 0065-3760), March 1986, p. 34-37. In English and French.

The design of SPOT which travels in a near-polar, sun-synchronous orbit 822 km above the earth is examined. The capabilities of the two high-resolution-visible imaging instruments that scan an area 117 km wide with a resolution of 10 m or 20 m are studied. The noncontinuous imaging process is described. The benefits SPOT provides to its customers including ecologists, geologists, and oceanographers are discussed. I.F.

A86-33317
AN ALGORITHM FOR THE IDENTIFICATION OF CLOUD COVER AND THE ESTIMATION OF SPECTRAL BRIGHTNESSES OF THE CLOUDLESS ATMOSPHERE ACCORDING TO SATELLITE SCANNING MEASUREMENTS OF OUTGOING IR RADIATION [OB ODNOM ALGORITME IDENTIFIKATSII OBLACHNOI I OTSENKI SPEKTRAL'NYKH IARKOSTEI BEZOBLACHNOI ATMOSFERY PO DANNYM SPUTNIKOVYKH SKANIRUIUSHCHIKH IZMERENII UKHODIASHCHEGO IK IZLUCHENIIA]
IU. V. PLOKHENKO and V. E. TRETIAKOV IN: Aspects of the processing and interpretation of measurement data from meteorological satellites . Leningrad, Gidrometeoizdat, 1985, p. 36-41. In Russian.

A86-33318
EXPERIMENTS ON THE REMOTE TEMPERATURE SOUNDING OF THE ATMOSPHERE ON THE BASIS OF NOAA-SATELLITE RADIOMETER MEASUREMENTS [EKSPERIMENTY PO DISTANTSIONNOMU TEMPERATURNOMU ZONDIROVANIIU ATMOSFERY NA OSNOVE RADIOMETRICHESKIKH IZMERENII S ISZ NOAA]
IU. M. TUMOFEEV, IU. V. PLOKHENKO, and A. B. USPENSKII IN: Aspects of the processing and interpretation of measurement data from meteorological satellites . Leningrad, Gidrometeoizdat, 1985, p. 42-49. In Russian. refs

A description is given of algorithms and programs for the secondary processing of measurements of outgoing radiation of the ground-atmosphere system, measured with the NOAA HIRS/2 radiometer of the TOVS system with the aim of atmospheric-temperature sounding. Results are presented of numerical experiments on temperature sounding based on HIRS/2 archive data prepared during the ALPEX experiment. B.J.

A86-33501* Massachusetts Univ., Amherst.
1985 INTERNATIONAL GEOSCIENCE AND REMOTE SENSING SYMPOSIUM (IGARSS '85), UNIVERSITY OF MASSACHUSETTS, AMHERST, OCTOBER 7-9, 1985, DIGEST. VOLUMES 1 & 2
K. R. CARVER, ED. (Massachusetts, University, Amherst) Symposium sponsored by IEEE, NASA, Navy, et al. New York, Institute of Electrical and Electronics Engineers, Inc., 1985. Vol. 1, 577 p.; vol. 2, 661 p. For individual items see A86-33502 to A86-33603, A86-33605 to A86-33647.

The present conference on remote sensing instrumentation considers topics in water resources research, planetary remote sensing and mathematical geophysics, sea ice behavior in view of the Cold Regions Research and Engineering Laboratories pond measurements, Shuttle Imaging Radar-B (SIR-B) system performance and calibration results, geological applications of remote sensing, and microwave scattering from vegetation. Further attention is given to atmospheric probing with lasers, image processing for remote sensing, forest inventory and condition assessment, atmospheric remote sensing, SIR-B geological results, the reflectance, emission, and scattering characteristics of vegetation, sea ice sensing, multipolarization SAR results, the theoretical modeling of surfaces and volumes, crop condition assessment and productivity estimates, and SIR-B results for vegetation cover. Also considered are the microwave remote sensing of soil moisture, advanced sensors, advanced information extraction, wind and wave remote observations, results from the ESA Remote Sensing satellite, large area crop and land cover statistics, SIR-B results for directional ocean wave spectra, seasonal snow cover, ice sheets, and lake ice, fundamental research in terrain remote sensing, image classification methods, vegetation stress detection, remote sensing of coastal processes, SAR systems and calibration, electromagnetic geophysical methods and signal processing, image processing techniques, and SAR internal wave measurements. O.C.

A86-33502
NOAA PLANS FOR REMOTE SENSING OF THE EARTH, OCEANS AND ATMOSPHERE
G. OHRING (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 2-8.

The National Oceanographic and Atmospheric Administration (NOAA) operates a multisatellite system, capable of continuous global coverage of the earth, which employs two polar-orbit Advanced Tiros-N (ATN) satellites, two Geostationary Operational Environmental Satellites (GOES), and two Landsats. Although the ATN and GOES satellites were designed for atmospheric observations, they furnish additional data on the land and ocean components of the earth system. Attention is presently given to NOAA plans for the improvement of this earth remote sensing satellite system in the near-term period ending in 1992 and in the long term period extending from there to the year 2000. O.C.

A86-33533
REMOTE SENSING OF CLOUDS
J. A. COAKLEY, JR. (National Center for Atmospheric Research, Boulder, CO) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 227-232. refs

An approach is described to the retrieval of cloud cover information from the imagery data of the Tiros-N Advanced Very High Resolution Radiometer, making it possible to probe the physical properties of clouds. The 65,000-pixel visible and IR images for a 1000 km x 1000 km area of the Pacific Ocean were constructed from data with a spatial resolution of 4 km x 4 km. To treat only partially cloud-covered pixels the spatial coherence method of Coakley and Bretherton (1982) was used. The method takes advantage of the fact that for many large-scale cloud systems, the clouds lie in distinct well-defined layers and are often opague at infrared wavelengths. A plot of the reflected 3.7-micron radiance data versus emitted 11-micron radiance for a single-layered cloud system observed during the day shows that cloud-covered pixels reflect less of the 3.7-micron radiation than do some of the pixels that are only partially cloud-covered. The reflectivity is greater for small, finite clouds because these clouds allow photons that enter the cloud top to escape through a side, while large extensive clouds would absorb the same photons. I.S.

A86-33545* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

PASSIVE REMOTE SENSING OF STRATOSPHERIC AND MESOSPHERIC WINDS

D. J. MCCLEESE and J. S. MARGOLIS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 333-338. NASA-supported research.

A passive infrared sensor for remote sounding of the wind field in the stratosphere and mesosphere from near earth orbital spacecraft is described. The sensor utilizes gas correlation spectroscopy and electrooptic phase-modulation techniques to measure winds in the 20-120 km altitude range, temperature, and atmospheric species concentrations. The operation of the sensor is examined. The sensitivity of the sensor is small Doppler shifts in an observed spectrum and the performance of the instrument were evaluated using laboratory simulation and numerical modeling. The data reveal that the sensor's wind measurements should have an accuracy better than 5 m/s and a spatial resolution of 5 km vertical by 150 km horizontal. I.F.

A86-33547

REMOTE SENSING OF VERTICAL MOISTURE PROFILES AND CLOUD PROPERTIES FROM SIMULATED MILLIMETER WAVE SOUNDER AND MICROWAVE IMAGER DATA

R. G. ISAACS and G. DEBLONDE (Atmospheric and Environmental Research Inc., Cambridge, MA) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 345-350. refs (Contract F19628-83-C-0027; F19628-84-C-0134)

A86-33584* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MICROWAVE BACKSCATTER AND EMISSION OBSERVED FROM SHUTTLE IMAGING RADAR B AND AN AIRBORNE 1.4 GHZ RADIOMETER

J. R. WANG, J. C. SCHIUE, T. J. SCHMUGGE (NASA, Goddard Space Flight Center, Greenbelt, MD), E. T. ENGMAN (USDA, Agricultural Research Center, Beltsville, MD), T. MO (Computer Sciences Corp., Beltsville, MD), and R. W. LAWRENCE (NASA, Langley Research Center, Hampton, VA) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 607-612. refs

A soil moisture experiment conducted with the Shuttle Imaging Radar B (SIR-B) is reported. SIR-B operated at 1.28 GHz provided the active microwave measurements, while a 4-beam pushbroom 1.4 GHz radiometer gave the complementary passive microwave measurements. The aircraft measurements were made at an altitude of 330 m, resulting in a ground resolution cell of about 100 m diameter. SIR-B ground resolution from 225 km was about 35 m. More than 150 agricultural fields in the San Joaquin Valley of California were examined in the experiment. The effect of surface roughness height on radar backscatter and radiometric measurements was studied. D.H.

A86-33586* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SPACEBORNE IMAGING RADAR (SIR) PROJECT

C. ELACHI, N. HERMAN (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), and K. CARVER (Massachusetts, University, Amherst) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 625-628.

An overview is given of elements of the SIR (Shuttle Imaging Radar) project, covering the coming decade. The project is intended to develop the scientific basis and the required technology of the Earth Orbiting Satellite (EOS) Synthetic Aperture Radar (SAR). Plans are ongoing for a SIR-B reflight in 1987, a dual SIR-C flight in 1989 and a SIR-D flight in 1992 leading to an advanced multispectral multipolarization imaging sensor for flight on EOS in 1994. The conventional and distributed radar approaches are compared. D.H.

A86-33588* Massachusetts Univ., Amherst.

ELECTRONICALLY STEERED THINNED ARRAY RADIOMETER (ESTAR) SYSTEM DESIGN, CALIBRATION, AND SENSITIVITY

C. RUF, C. T. SWIFT (Massachusetts, University, Amherst), and D. LEVINE (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 635-640. refs

The ESTAR system, an imaging L-band radiometer designed to provide measurements of soil moisture from space, is described. The large aperture size dictated by the resolution requirement (10 km or less) suggests the use of aperture synthesis, and plans to have ESTAR operate in low earth orbit require that the synthesis be performed in the short data acquisition time permitted by satellite motion. Two forms of ESTAR are described. ESTAR-0 is to be an airborne prototype designed for proof of concept; it will image a line of eight adjacent pixels with 8 degree spatial resolution of 0.1 degree Kelvin temperature resolution, given 1 sec integration time. ESTAR-1 is the satellite version to operate from space. A tentative sensor design will image a line of 128 0.5 degree pixels with 2.0 degree K resolution assuming 0.7 sec integration at 700 km altitude. D.H.

A86-33589

PUSH-BROOM MICROWAVE RADIOMETER SYSTEMS FOR SPACE APPLICATIONS

N. SKOU (Danmarks Tekniske Hojskole, Lyngby, Denmark) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 641-646. ESA-supported research. refs

A comparison is given between the conventional method of imaging the earth's surface by scanning a single beam antenna carried by a satellite and the pushbroom approach which does not use a scanning antenna. In the pushbroom approach, a multiple beam antenna covers the swath while the satellite moves forward; numbers of radiometer receivers are connected to an equal number of antenna feeds to sense the earth simultaneously. Relationships between swath width, footprint, integration time, satellite height, frequency AO are presented for earth oriented imaging systems. Three specific examples of geophysical measurement situations calling for the pushbroom solution are dealt with: sea ice mapping, coastal salinity, and soil moisture measurements. D.H.

A86-33590* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

HIGH RESOLUTION MILLIMETER-WAVE IMAGING SENSOR

W. J. WILSON, R. J. HOWARD, and G. S. PARKS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 647-649. Army-supported research.

A scanning 3-mm radiometer is described that has been built for use on a small aircraft to produce real time high resolution images of the ground when atmospheric conditions such as smoke, dust, and clouds make IR and visual sensors unuseable. The sensor can be used for a variety of remote sensing applications such as measurements of snow cover and snow water equivalent, precipitation mapping, vegetation type and extent, surface moisture and temperature, and surface thermal inertia. The advantages of millimeter waves for cloud penetration and the ability to observe different physical phenomena make this system an attractive supplement to visible and IR remote sensing systems. D.H.

A86-33623* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EXTENDED TESTING OF A GENERAL CONTEXTUAL CLASSIFIER USING THE MASSIVELY PARALLEL PROCESSOR - PRELIMINARY RESULTS AND TEST PLANS

J. C. TILTON (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 900-905. refs

Earlier encouraging test results of a contextual classifier that combines spatial and spectral information employing a general statistical approach are expanded. The earlier results were of limited meaning because they were produced from small (50-by-50 pixel) data sets. An implementation of the contextual classifier on NASA Goddard's Massively Parallel Processor (MPP) is presented; for the first time the MPP makes feasible the testing of the classifier on large data sets (a 12-hour test on a VAX-11/780 minicomputer now takes 5 minutes on the MPP). The MPP is a Single-Instruction, Multiple Data Stream computer, consisting of 16,384 bit serial microprocessors connected in a 128-by-128 mesh array with each element having data transfer connections with its four nearest neighbors so that the MPP is capable of billions of operations per second. Preliminary results are given (with more expected for the conference) and plans are mentioned for extended testing of the contextual classifier on Thematic Mapper data sets. D.H.

A86-33633

SNR IN SAR

R. K. RANEY (RADARSAT, Ottawa, Canada) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 994-999. refs

The issue of signal-to-noise ratio for a synthetic aperture radar (SAR) observing extended natural terrain is readdressed. The generally accepted form of the SNR equation (providing the design basis of famous SARs) is only 'almost correct' and actually depends on two offsetting errors for its success. It is not appropriate to substitute an area increment of average reflectivity for peak point target reflectivity, nor is it correct phenomenologically to apply coherent gain to mean power measures. An expression is given that retains the minimum parameters essential to describe SAR sensitivity to uniform natural scatterers and is based on more appropriate application of SAR operation. D.H.

A86-33634* Environmental Research Inst. of Michigan, Ann Arbor.

VERIFICATION OF L-BAND SAR CALIBRATION

R. W. LARSON, P. L. JACKSON, and E. KASISCHKE (Michigan, Environmental Research Institute, Ann Arbor) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 1001-1006. NASA-supported research. (Contract N00014-81-C-0692)

Absolute calibration of a digital L-band SAR system to an accuracy of better than 3 dB has been verified. This was accomplished with a calibration signal generator that produces the phase history of a point target. This signal relates calibration values to various SAR data sets. Values of radar cross-section (RCS) of reference reflectors were obtained using a derived calibration relationship for the L-band channel on the ERIM/CCRS X-C-L SAR system. Calibrated RCS values were compared to known RCS values of each reference reflector for verification and to obtain an error estimate. The calibration was based on the radar response to 21 calibrated reference reflectors. Author

A86-33636

RESEARCH AND DEVELOPMENT OF THE SYNTHETIC APERTURE RADAR TRANSMITTER AND RECEIVER SUBSYSTEM DESIGN AND SOME COMPONENT TEST RESULTS

I. IZUMI, K. NISHIKOWA, Y. UENO, M. FUKAI, K. TANAKA (NEC Corp., Tokyo, Japan) et al. IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 1014-1017.

An account is given of research and development work on synthetic aperture radar for earth observation satellites, with reference to the Japanese Earth Resources Satellite-1, to be launched in FY 1990. The subsystem design to establish the functions, configuration, and main design parameters for this equipment is described. Test results are given for some key components of the SAR transmitter and receiver. D.H.

A86-33641

HIGH SPEED IMAGE PROCESSING SYSTEM WITH CUSTOM VLSI FOR DSP

M. KUBO, Y. KUNIYASU, S. HORII, A. KAHUMA, M. SUGAI (Toshiba Corp., Kawasaki, Japan) et al. IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 2 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 1097-1102. refs

The error in the sum of products operation caused by the underflow in the accumulator of the VLSI is analyzed and avoided by its sizing. The effect of word length constraint in FFT and inverse FFT in series is measured by simulation to size the VLSI. The outlook for the precise and fast image processing is examined; 100 km x 100 km SAR image formation is done within six minutes with 16 VLSIs in parallel. Author

A86-34112#

COMMERCIAL APPLICATIONS OF THE NAVSTAR GLOBAL POSITIONING SYSTEM

M. W. MILLER (Rockwell International Corp., Satellite Systems Div., Washington, DC) IN: U.S. Opportunities in Space Conference; Proceedings of the Second Annual Space Business Conference, Washington, DC, October 30-November 1, 1985 . London, Space Consultants International, Ltd., 1985, 10 p.

The characteristics and operation of the Global Positioning System (GPS) are described. The benefits GPS will provide to civilian air, sea, land, and space travel are discussed. Specific commercial applications for the satellite system, which include air traffic control, time synchronization, and oil exploration, are analyzed. I.F.

A86-34736

TERRAIN HEIGHT MEASUREMENT BY SYNTHETIC APERTURE RADAR WITH AN INTERFEROMETER

H. HIROSAWA and N. KOBAYASHI (Tokyo, University, Japan) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, March 1986, p. 339-348. refs

This paper describes the terrain height measurement capability of synthetic aperture radar with an interferometer assuming the radar operates on a satellite. The interferometer phase measurement uncertainty due to additive thermal noise and multiplicative speckle noise, which determine the upper limit of the height measurement accuracies of this radar system, has been obtained by numerical simulation. The height measurement accuracies attainable on relatively flat terrain areas are of roughly the same order as range resolution when C- or X-band radar is operated at an altitude of 300 km. Author

A86-34737

AN INTEGRATED APPROACH TO GEOMETRIC PRECISION PROCESSING OF SPACEBORNE HIGH-RESOLUTION SENSORS

A. MOCCIA and S. VETRELLA (Napoli, Universita, Naples, Italy) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, March 1986, p. 349-359. Research supported by the Ministero della Pubblica Istruzione and CNR. refs

The planimetric errors due to terrain relief and atmospheric refraction must be considered when high geometric resolution sensors and off-nadir viewing angles are used. This paper presents an approach to correct these errors using an integrated procedure that takes into account geometric and radiometric effects, connected to simulations of future remote-sensing systems or precision data processing. A diagram shows the relation between the root mean square error of the digital elevation model necessary to correct the terrain relief effect and the achievable scale of the output image map. The procedure is currently applied to the SPOT simulation on the Basilicata test site in southern Italy. A short example is given to analyse the geometric errors involved. Author

A86-35425

ASIAN CONFERENCE ON REMOTE SENSING, 5TH, KATHMANDU, NEPAL, NOVEMBER 15-18, 1984, PROCEEDINGS

Conference sponsored by the Ministry of Forest and Soil Conservation of Nepal, Japan Association of Remote Sensing, Tokai University, et al. Tokyo, University of Tokyo, 1985, 503 p. No individual items are abstracted in this volume.

Papers are presented on remote sensing activities in Bangladesh, China, India, Japan, Sri Lanka, Singapore, Nepal, and Asia; airborne radar system use in topographic mapping; photometric camera mission on Spacelab 1; and the use of remote sensing technique in archaeology. Topics discussed include the application of remote sensing to agriculture/forestry, landuse/cartography, water resources/oceanography, and geology and geomorphology. Consideration is given to the utilization of continuation methods is enhancement of satellite/low flying MSS digital imagery; three dimensional measurement by stereo Landsat MSS CCT data; tachometry by a nonmetric camera in a model plane; print plotted false color imageries and its use in remote sensing studies; application of airborne multispectral scanners; remote sensing inputs to resource data management system for developing countries; photogrammetric accuracy of stereo space photographs taken by metric camera from Spacelab 1; remotely sensed canopy temperature based models for estimating evapotranspiration; and the use of color plotter to generate high resolution image pixels. I.F.

A86-36060

PRACTICAL PHOTOGRAMMETRY FROM 35-MM AERIAL PHOTOGRAPHY

A. ROBERTS and L. GRISWOLD (Simon Fraser University, Burnaby, Canada) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, April 1986, p. 501-508. refs

To date, photogrammetry has been primarily concerned with the analysis of 240-mm photographs or transparencies taken with metric cameras. With advances in microcomputer controlled analytical stereoplotters, 35-mm aerial photography can achieve acceptable levels of accuracy. The photogrammetric accuracy of 35-mm aerial photography was analyzed using a modified Zeiss G-2 Stereocord. The imagery distortions were corrected using the analytical orientation procedures of the stereoplotting hardware-software system. Vertical measurements deviated not more than + or - 0.001 of the flying height from ground truth values. These results are within precision standards for many practical photogrammetry applications. Author

A86-36514

CHOICE OF SPECTRAL BANDS FOR A SPACEBORNE MULTISPECTRAL SCANNER [VYBOR ZON SPEKTRA PRI KOSMICHESKOI S'EMKE]

N. A. TEPLIAKOV and V. M. CHERNIN IN: Methods of combined air and space remote-sensing studies of Siberia . Novosibirsk, Izdatel'stvo Nauka, 1985, p. 72-75. In Russian.

A graph-analytical method based on the simultaneous analysis of the parameters of the scanning objects is presented for determining the optimal spectral bands for a multispectral scanner. Recommendations are given on the improvement of remote-sensing optical filters and on the compilation of a spectral-contrast catalog for remote-sensing objects. B.J.

A86-36785

SATELLITE REMOTE SENSING OF ATMOSPHERIC OPTICAL DEPTH SPECTRUM

S. ARANUVACHAPUN (Exeter, University, England) (Workshop on Atmospheric Corrections, University of Nottingham, England, May 22, 1985) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, April 1986, p. 499-514. refs

Satellite radiance data are applied to the study of optical depth and aerosol radiative transfer in the atmosphere. The collection of the coastal zone color scanner (CZCS) radiance data and measured aerosol size distribution data utilized in this analysis is described. The equations for computing the radiance of the aerosol size distribution and oceanic surface albedo are presented. The variability of the aerosol phase function, which represents the aerosol radiative transfer in the atmosphere, is examined. CZCS and the computed radiance data are compared and an optical depth spectrum is derived. The results reveal that there is a strong dependence of optical depth on the wavelength. It is noted that ocean color remote-sensing data is useful for estimating the optical depth spectrum of the earth's atmosphere. I.F.

A86-36838*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SAGE OBSERVATIONS OF STRATOSPHERIC NITROGEN DIOXIDE

W. P. CHU and M. P. MCCORMICK (NASA, Langley Research Center, Hampton, VA) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, April 30, 1986, p. 5465-5476. refs

The global distribution of nitrogen dioxide in the middle to upper stratosphere (25-45 km altitude) for the period February 1979 to November 1981 has been determined from observations of attenuated solar radiation in the visible region 0.385-0.45 micron by the Stratospheric Aerosol and Gas Experiment (SAGE) satellite instrument. The SAGE-derived NO2 vertical profiles compare well with observations by balloon- and aircraft-borne sensors. The global SAGE NO2 distributions generally show a maximum in mixing ratio of 8 parts per billion by volume at about 35 km altitude near the equatorial latitudes at local sunset. The location of the mixing ratio peak moves synchronously with the overhead sun for the four different seasons. High-latitude NO2 column content shows strong seasonal variation, with a maximum in local summer and a minimum in local winter. Selected data at high-latitude winter seasons are presented, suggesting that the large variation shown could be explained by the coupling of both dynamics and photochemistry of the NO(x) species. Finally, profiles of the ratio of sunset to sunrise NO2 mixing ratios, peaking, at about a factor of two at 30 km, are shown. Author

A86-37001

MACHINE PROCESSING OF REMOTELY SENSED DATA - QUANTIFYING GLOBAL PROCESS: MODELS, SENSOR SYSTEMS, AND ANALYTICAL METHODS; PROCEEDINGS OF THE ELEVENTH INTERNATIONAL SYMPOSIUM, PURDUE UNIVERSITY, WEST LAFAYETTE, IN, JUNE 25-27, 1985

S. K. MENGEL, ED. and D. B. MORRISON, ED. Symposium sponsored by the American Society of Agronomy, Crop Science Society of America, IEEE, et al. New York, Institute of Electrical and Electronics Engineers, 1985, 380 p. For individual items see A86-37002 to A86-37036.

Consideration is given to global biogeochemical issues, image processing, remote sensing of tropical environments, global processes, geology, landcover hydrology, and ecosystems modeling. Topics discussed include multisensor remote sensing strategies, geographic information systems, radars, and agricultural remote sensing. Papers are presented on fast feature extraction; a computational approach for adjusting TM imagery terrain distortions; the segmentation of a textured image by a maximum likelihood classifier; analysis of MSS Landsat data; sun angle and background effects on spectral response of simulated forest canopies; an integrated approach for vegetation/landcover mapping with digital Landsat images; geological and geomorphological studies using an image processing technique; and wavelength intensity indices in relation to tree conditions and leaf-nutrient content. I.F.

A86-37007

THE EMERGENCE OF AIRBORNE VIDEO TECHNIQUES AS AN ALTERNATIVE FOR ACCESSING TROPICAL ENVIRONMENTS - A HISTORICAL PERSPECTIVE

R. D. MOWER (North Dakota, University, Grand Forks) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 59-64. refs

The development of remote sensing systems is discussed. The use of video technology to acquire airborne video data and techniques for analyzing the data are described. The application of airborne video technology to tropical areas in developing countries is examined. Examples of remote sensing projects that employed airborne video technology are presented. I.F.

A86-37343

APPLICATIONS OF SENSOR PAYLOADS

J. W. JACK (Ferranti Defence Systems, Ltd., Electro-Optics Dept., Edinburgh, Scotland) IN: Remotely piloted vehicles; International Conference, 5th, Bristol, England, September 9-11, 1985, Supplementary Papers . Bristol, England, University of Bristol, 1985, p. 17.1-17.7.

An account is given of the availability and performance capabilities of TV, intensified TV, pyroelectric vidicon, and thermal imaging systems applicable to visible to far-IR sensing tasks aboard RPV platforms. Attention is given to a number of payload configurations which, while conceived to meet a military requirement for the detection and recognition of a military vehicle, are not restricted to military applications. Civilian applications include thermal emission surveys for local governments and industrial concerns, traffic flow pattern surveillance, and pipeline and transmission line surveys. O.C.

A86-38659

THE ARGOS SYSTEM FOR POSITIONING AND DATA COLLECTION BY SATELLITE - CHARACTERISTICS AND PERFORMANCE LEVELS [LE SYSTEME ARGOS DE LOCALISATION ET DE COLLECTE DE DONNEES PAR SATELLITE CARACTERISTIQUES ET PERFORMANCES]

R. ROSSO (CNES, Paris, France) Navigation (Paris) (ISSN 0028-1530), vol. 34, April 1986, p. 187-195. In French.

The ARGOS system was developed jointly by CNES, NASA and NOAA for positioning and data collection purposes after the success of the Eole satellite in relaying meteorological balloon data. The system has three segments: data collection stations, two meteorological satellites, and a ground system for receiving, storing and processing the data. The data gathering equipment is located at 750 sites in 24 countries and on ships at sea. Transmissions to the satellites for relay are performed at 401.650 MHz. The satellites fly an 850 km altitude polar orbit, each having 250 data collection platforms in line-of-sight link at all times. Each data stream received is marked to identify the transmitting station, time and frequency of the transmission. The central data treatment facility is at Toulouse; receiving stations are also located in Alaska, Virginia and Lannion. The data is stored for remote interrogation through telephone links. The satellites transmit signals at 401.650 MHz, which permits positioning by measurement of the Doppler effect so long as precise orbital predictions for the spacecraft are available. M.S.K.

A86-39069

THE EFFECT OF THE ATMOSPHERE ON THE SATELLITE REMOTE SENSING OF EARTH RESOURCES [VLIIANIE ATMOSFERY NA ISSLEDOVANIIA PRIRODNYKH RESURSOV IZ KOSMOSA]

K. IA. KONDRATEV, O. I. SMOKTII, and V. V. KOZODEROV Moscow, Izdatel'stvo Mashinostroenie, 1985, 272 p. In Russian. refs

The work examines the development of algorithms and schemes for the atmospheric radiation correction of satellite remote-sensing data. Attention is given to theoretical aspects of the solution of direct and inverse problems connected with the analysis of outgoing-radiation fields of the system consisting of the atmosphere and a horizontal inhomogeneous underlying surface. Computing systems are described which make possible the real-time correction of spectral-band photographs and spectrograms of earth resources. B.J.

N86-23025# Sherbrooke Univ. (Quebec). Dept. de Geographie.

THE FUNDAMENTALS OF MICROWAVE REMOTE SENSING [LES MICRO-ONDES EN TELEDETECTION]

P. DESFOSSES, J. M. M. DUBOIS, and F. BONN Oct. 1985 126 p refs In FRENCH; ENGLISH summary
(SU-84; SU-85; ISSN-0710-0868) Avail: NTIS HC A07/MF A01

Fundamentals of microwave remote sensing are presented. It is noted that there is a need for a simple introduction to this specialized subject. The fundamentals of microwave physics are introduced. Radar systems, wave interaction with natural surfaces and interpretation of radar imagery are discussed. E.A.K.

N86-23159*# Oklahoma Univ., Norman. National Severe Storms Lab.

ANALYSIS OF AIRBORNE DOPPLER LIDAR, DOPPLER RADAR AND TALL TOWER MEASUREMENTS OF ATMOSPHERIC FLOWS IN QUIESCENT AND STORMY WEATHER Contractor Report, 27 Apr. 1982 - 31 Jul. 1985

H. B. BLUESTEIN, R. J. DOVIAK, M. D. EILTS, E. W. MCCAUL, R. RABIN, A. SUNDARA-RAJAN, and D. S. ZRNIC Washington NASA Feb. 1986 178 p refs
(Contract NAS8-34749)
(NASA-CR-3960; NAS 1.26:3960) Avail: NTIS HC A09/MF A01 CSCL 04B

The first experiment to combine airborne Doppler Lidar and ground-based dual Doppler Radar measurements of wind to detail the lower tropospheric flows in quiescent and stormy weather was conducted in central Oklahoma during four days in June-July 1981.

Data from these unique remote sensing instruments, coupled with data from conventional in-situ facilities, i.e., 500-m meteorological tower, rawinsonde, and surface based sensors, were analyzed to enhance understanding of wind, waves and turbulence. The purposes of the study were to: (1) compare winds mapped by ground-based dual Doppler radars, airborne Doppler lidar, and anemometers on a tower; (2) compare measured atmospheric boundary layer flow with flows predicted by theoretical models; (3) investigate the kinematic structure of air mass boundaries that precede the development of severe storms; and (4) study the kinematic structure of thunderstorm phenomena (downdrafts, gust fronts, etc.) that produce wind shear and turbulence hazardous to aircraft operations. The report consists of three parts: Part 1, Intercomparison of Wind Data from Airborne Lidar, Ground-Based Radars and Instrumented 444 m Tower; Part 2, The Structure of the Convective Atmospheric Boundary Layer as Revealed by Lidar and Doppler Radars; and Part 3, Doppler Lidar Observations in Thunderstorm Environments. Author

N86-23160*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SITE SELECTION AND DIRECTIONAL MODELS OF DESERTS USED FOR ERBE VALIDATION TARGETS
W. F. STAYLOR Apr. 1986 15 p refs
(NASA-TP-2540; L-16041; NAS 1.60:2540) Avail: NTIS HC A02/MF A01 CSCL 04B

Broadband shortwave and longwave radiance measurements obtained from the Nimbus 7 Earth Radiation Budget scanner were used to develop reflectance and emittance models for the Sahara, Gibson, and Saudi Deserts. These deserts will serve as in-flight validation targets for the Earth Radiation Budget Experiment being flown on the Earth Radiation Budget Satellite and two National Oceanic and Atmospheric Administration polar satellites. The directional reflectance model derived for the deserts was a function of the sum and product of the cosines of the solar and viewing zenith angles, and thus reciprocity existed between these zenith angles. The emittance model was related by a power law of the cosine of the viewing zenith angle. Author

N86-23962 Deutsche Geodaetische Kommission, Munich (West Germany).
RECTIFICATION OF SCANNER IMAGES USING PREDICTION APPROACHES Ph.D. Thesis - Bonn Univ. [ENTZERRUNG VON SCANNERBILDERN MIT PRAEDIKTIONSANSAETZEN]
A. ROSE Bayerischen Akademie der Wissenschaften 1984 85 p refs In GERMAN
(SER-C-303; ISBN-3-7696-9353-1; ISSN-0065-5325) Avail: Issuing Activity

The rectification of airborne scanner data was investigated. The concept on which the covariance estimation is based, and the resulting prediction formulas are explained; the common ground and differences with the Ebner method are discussed. The developed method was tested on airborne scanner images. The prediction of the image rectification results from the prediction of orientation parameters; the model combines interpolation and parametric methods. A modular programming system was developed to conduct the rectification work; the programming package consists of a prediction and an image processing part. The test results satisfy expectations; a substantial increase in accuracy is obtained. The improvements depend on the number and the quality of the control points. Author (ESA)

N86-24000# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.
SATELLITE-BORNE 90 GHZ RADIOMETER EXPERIMENT (SABREX), PHASE A1
D. SALZER, H. KIETZMANN, P. SLIWINSKI, B. AUMILLER, H. BLOETSCHER, and R. SCHMID Jun. 1985 174 p refs
(DFVLR-MITT-85-13; ISSN-0176-7739) Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 51

Flight configurations for a 90 GHz satellite radiometer on a Stretched ROHINI Satellite bus are discussed. The satellite can be flown with its longitudinal symmetry axis in nadir direction (configuration 1) and with its longitudinal symmetry axis in direction of the velocity vector (configuration 2). Configuration 2 has a longer feeding system, lower overall noise due to lower feed system sidelobes, and better scanning possibilities. The main scientific objective of this experiment is the analysis of the capabilities of a 90 GHz satellite radiometer to determine the fluid water content of clouds, to measure low rain rates, to map the cloud cover and extended targets (diameter 1 km) and to map snow cover. Instrument design, radiometer calibration, data processing, ground support, and development schedule are considered.
Author (ESA)

N86-24003# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Systems Space Group.
MOMS-01 (MODULAR OPTOELECTRONIC MULTISPECTRAL SCANNER) FOR EARTH OBSERVATION: FIRST RESULTS OF STS-7 MISSION
D. MEISSNER, H. LAUCHT, J. BODECHTEL, and R. HAYDN 1985 15 p refs Presented at 1983 Joint International Geoscience and Remote Sensing Symposium (IGARSS 83) and National Radio Science-Commission F Meeting, FA-4, San Francisco, Calif., 31 Aug. - 2 Sep. 1983 Previously announced in IAA as A85-35050 Original contains color illustrations
Avail: NTIS HC A02/MF A01

The MOMS design is outlined and results from STS-7 are described. The mission included mapping of different ground targets with low to high contrast and albedo in visible and near infrared part of the spectrum over arid areas, areas with dense and sparse natural vegetation, coastal zones, mountainous regions and open ocean islands. System verification was achieved under space conditions for a 2-channel version to demonstrate the capability for scan line extension and the ability to combine pixel-coincident modules. Author (ESA)

N86-24128*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GLAS EXPERIMENTS ON THE IMPACT OF FGGE SATELLITE DATA ON NUMERICAL WEATHER PREDICTION
E. KALNAY, R. ATLAS, W. E. BAKER, and J. SUSSKIND *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 p 121-145 Oct. 1985 refs
Avail: NTIS HC A17/MF A01 CSCL 04B

Simulation studies and pre-FGGE data impact studies were briefly reviewed. Impact of Goddard Laboratory for Atmospheric Science temperature soundings and cloud tracked winds was also examined. B.G.

N86-24160*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIMULATION STUDIES RELATED TO THE DESIGN OF POST-FGGE OBSERVING SYSTEMS Final Report
M. HALEM, R. ATLAS, and J. SUSSKIND *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 p 727-760 Oct. 1985 refs
Avail: NTIS HC A18/MF A01 CSCL 04B

The results of three detailed simulation studies are presented. The first study consists of a comparative assessment of the performance of an advanced moisture/temperature sounder (AMTS) being proposed by NASA as a follow-on replacement to the current HIRS-2 operational sounder aboard the NOAA weather satellites. The second study was concerned with assessing the relative accuracies of inferred atmospheric states for idealized lidar wind profiling systems, temperature profiling systems, temperature profiling systems, surface pressure systems, and composite systems. The third study incorporated the above systems into a highly realistic data analysis/forecast cycle from which a series of forecast impact studies were conducted. These studies, taken together, give us a picture of the potential that emerging technologies can offer in the determination of the basic atmospheric variables required for long-range numerical weather and climate prediction.
Author

N86-25064# Naval Postgraduate School, Monterey, Calif.
SATELLITE CLOUD AND PRECIPITATION ANALYSIS USING A MINICOMPUTER Technical Report, Oct. 1983 - Oct. 1985
C. H. WASH, L. A. SPRAY, and L. C. CHOU Nov. 1985 94 p refs
(AD-A163821; NPS63-85-003) Avail: NTIS HC A05/MF A01 CSCL 04B

A satellite-derived cloud and precipitation analysis program has been developed for an interactive mini-computer system. The program utilizes geostationary infrared and visual data with operational upper air and surface temperature analyses to specify cloud-type, cloud amount, cloud-top temperature, cloud-top height and estimate precipitation intensity. Five cases of GOES-East data (2 x 2 n mi visual and 2 x 4 n mi infrared) for an approximately 1600 x 1600 n mi area over the eastern United States and western North Atlantic Ocean are used in evaluating the model's performance. Each satellite-derived, cloud and precipitation analysis is evaluated subjectively, using conventional synoptic data, radar measurements and manual nephanalysis for verification, and objectively, using surface synoptic observations for verification. Successful estimates of cloud amount for overcast and clear skies were obtained; however, broken and scattered conditions were underestimated. The majority of stratiform cloud types and multi-layered clouds were analyzed correctly by the model. Classification errors occurred with cumuliform clouds and thin cirrus. Reasonable precipitation intensity and cloud-top temperature/height analyses were produced by the NPS model. GRA

N86-25925# Lawrence Livermore National Lab., Calif.
STUDIES OF COMPLEX TERRAIN WIND FLOWS USING ACOUSTIC SOUNDER AND OPTICAL CROSS-WIND REMOTE SENSORS
W. M. PORCH, W. NEFF, and C. KING Aug. 1985 26 p refs
(Contract W-7405-ENG-48)
(DE86-002993; UCID-20519; ASCOT-85-2) Avail: NTIS HC A03/MF A01

Remote sensing instrumentation has played an important role in the Atmospheric Studies in Complex Terrain (ASCOT) field experimental program. The goal of this program is to better understand transport and diffusion processes in complex terrain with an emphasis focused on nighttime drainage wind conditions. Two aspects of the instrumentation are discussed: acoustic sounders (doppler and monostatic) and space averaging optical crosswind sensors. Data from these two sources are discussed and compared with data from conventional tower and tethersonde instrumentation. DOE

N86-27705*# Arizona Univ., Tucson. Optical Sciences Center.
SPECTRORADIOMETRIC CONSIDERATIONS FOR ADVANCED LAND OBSERVING SYSTEMS Final Report
P. N. SLATER Jul. 1986 101 p
(Contract NAG5-196)
(NASA-CR-177205; NAS 1.26:177205) Avail: NTIS HC A06/MF A01 CSCL 08B

Research aimed at improving the inflight absolute radiometric calibration of advanced land observing systems was initiated. Emphasis was on the satellite sensor calibration program at White Sands. Topics addressed include: absolute radiometric calibration of advanced remote sensing; atmospheric effects on reflected radiation; inflight radiometric calibration; field radiometric methods for reflectance and atmospheric measurement; and calibration of field relectance radiometers. B.G.

09

GENERAL

Includes economic analysis.

A86-34111#
A MULTI-NATIONAL CONSORTIUM OPPORTUNITY FOR REMOTE SENSING
P. M. MAUGHAN (Space Development Services, Washington, DC) IN: U.S. Opportunities in Space Conference; Proceedings of the Second Annual Space Business Conference, Washington, DC, October 30-November 1, 1985 . London, Space Consultants International, Ltd., 1985, 10 p.

The development of a multinational consortium for remote sensing is proposed. Problems that could result, such as data censorship, as multiple sensing systems compete for commercial success are examined. The advantages a consortium would provide to remote sensing data users are discussed. The consortium is to be composed of public or private space-related organizations and to construct, launch, and operate satellite systems. The control each member country would have over the operation of the consortium and the access to data is described. I.F.

A86-34118#
'NEW OPPORTUNITIES IN REMOTE SENSING'
L. P. MITCHELL (Eastman Kodak Co., Rochester, NY) IN: U.S. Opportunities in Space Conference; Proceedings of the Second Annual Space Business Conference, Washington, DC, October 30-November 1, 1985 . London, Space Consultants International, Ltd., 1985, 11 p.

Technical and business activities in remote sensing are described. The need for improvements in satellite sensors and computer hardware necessary for the acquisition of higher spatial and spectral resolution data, the storage of more information, and faster retrieval of the data is examined. The development of software, algorithms, and techniques which will improve the processing and enhance the data is studied. The teaching and training of customers on the applications of the remote sensing data and the proper marketing of the information are discussed. I.F.

A86-37002
THE EVOLUTION OF REMOTE SENSING SCIENCE AND APPLICATIONS
J. H. MCELROY (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) IN: Machine processing of remotely sensed data - Quantifying global process: Models, sensor systems, and analytical methods; Proceedings of the Eleventh International Symposium, West Lafayette, IN, June 25-27, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 4-11. refs

The development of space observation systems and their applications are examined. The satellite systems that provide meteorological, oceanographic, land-science, and atmospheric data are described. The use of NASA's Polar Platform for observational missions is proposed. The need for data systems which process and distribute data quickly and accurately is discussed. I.F.

N86-25076# National Academy of Sciences - National Research Council, Washington, D. C.
EARTH SCIENCE INVESTIGATIONS IN THE UNITED STATES ANTARCTIC RESEARCH PROGRAM (USARP) FOR THE PERIOD JULY 1, 1984 - JUNE 30, 1985
1985 87 p Sponsored in part by the National Science Foundation, Washington, D.C.
(Contract NSF DPP-82-07098)
(PB86-143773) Avail: NTIS HC A05/MF A01 CSCL 08G

A listing of earth science research activities was conducted as part of the U.S. Antarctic Research Program for the year July 1, 1984, through June 30, 1985. Publications resulting from the research are also listed. Information was obtained by a survey of participants in the U.S. Antarctic Program, with respondents providing the data on their work in camera-ready format. GRA

N86-26355*# National Aeronautics and Space Administration, Washington, D.C.

ENVIROSAT-2000 REPORT: FEDERAL AGENCY SATELLITE REQUIREMENTS

D. COTTER, ed., I. WOLZER, ed., N. BLAKE, J. JARMAN, D. LICHY, T. PANGBURN, R. MCARDLE, C. PAUL, L. SHAFFER, G. THORLEY et al. NOAA Jul. 1985 156 p refs

(NASA-TM-88752; NAS 1.15:88752) Avail: NTIS HC A08/MF A01 CSCL 22B

The requirement of Federal agencies, other than NOAA, for the data and services of civil operational environmental satellites (both polar orbiting and geostationary) are summarized. Agency plans for taking advantage of proposed future Earth sensing space systems, domestic and foreign, are cited also. Current data uses and future requirements are addressed as identified by each agency. B.G.

N86-27410# National Oceanic and Atmospheric Administration, Washington, D. C. Natl. Environ. Satellite Data and Inform. Service.

FEDERAL AGENCY SATELLITE REQUIREMENTS Final Report

D. COTTER and I. WOLZER Jul. 1985 160 p

(AD-A165071) Avail: NTIS HC A08/MF A01 CSCL 04B

This report summarizes the requirements of Federal agencies for the data and services of NOAA's civil operational environmental satellites--both polar-orbiting and geostationary. The Federal agencies contributing to this document have described their current and planned use of the data and services provided by NOAA's environmental satellite and Landsat systems, as well as those provided by the systems of others. Agency plans for taking advantage of proposed future Earth-sensing space systems, domestic and foreign, are cited also. The report emphasizes requirements for direct and indirect support from NOAA's environmental satellite systems. In the direct case, the agencies process, interpret, or use NOAA's satellite data, products, or services as inputs to in-house activities. In the indirect case, NOAA provides the agencies with support products, such as weather forecasts, that depend on satellite operations to various degrees. This report focuses on the direct requirements served by the National Environmental Satellite Data, and Information Service (NESDIS). Described here are the satellite needs of the Department of Agriculture, the Army Corps of Engineers, the Department of Transportation (which includes the Federal Aviation Administration and the Coast Guard), the Agency for International Development, the Department of Defense, the Department of the Interior, and the National Aeronautics and Space Administration. Current data uses and future requirements are addressed. GRA

N86-27411# National Oceanic and Atmospheric Administration, Washington, D. C. Natl. Environ. Satellite Data and Inform. Service.

GOES (GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE)-NEXT OVERVIEW Final Report

A. SCHWALB, D. COTTER, and J. HUSSEY Sep. 1985 76 p

(AD-A165080) Avail: NTIS HC A05/MF A01 CSCL 22B

This report describes, in summary form, the current National Oceanic and Atmospheric Administration (NOAA) Geostationary Operational Environmental Satellite (GOES) system and the scientific rationale used to develop specifications for the next generation of satellites of this series. The payload instruments of the current satellites are reviewed in conjunction with the products prepared from their data outputs. The rationale used by the National Weather Service (NWS) in developing top-level requirements for GOES-Next stresses the projected use of data within the restructured NWS organization expected in the 1990's. NOAA-certified requirements used by the National Aeronautics and Space Administration (NASA) to develop the Request for Proposal, issued to industry in June 1984, are also provided. Finally, a brief description of the satellite system that will be built for launch in the 1990's is provided. This final section has been abstracted from the winning proposal submitted by Ford Aerospace and Communications Corporation and is a glimpse at what the future has in store for GOES. Author (GRA)

N86-27412# National Oceanic and Atmospheric Administration, Washington, D. C. Natl. Environ. Satellite Data and Inform. Service.

OPERATIONAL SATELLITE SUPPORT TO SCIENTIFIC PROGRAMS Final Report

H. W. YATES, D. J. COTTER, and G. OHRING Mar. 1985 57 p

(AD-A165081) Avail: NTIS HC A04/MF A01 CSCL 22B

The role of operational environmental satellites in science programs undertaken to study the Earth system is examined. It centers on the satellite systems operated by the National Oceanic and Atmospheric Administration (NOAA). Other satellite systems are referenced as appropriate. NOAA's operational satellites are serving the research community extensively. Research programs such as climate studies, ocean dynamics investigations, and global vegetation surveys benefit from the special characteristics of operational satellites. Among these characteristics are routine global coverage in many spectral intervals; reliability, resulting from a commitment to continue the service; speed in data access because of real-time applications; repeatability of measurements because of matched, calibrated instruments; and data handling methods that provide output products in conventional, usable formats and with traceable histories. Author (GRA)

N86-27413# National Oceanic and Atmospheric Administration, Washington, D. C.

COMPARISON OF THE DEFENSE METEOROLOGICAL SATELLITE PROGRAM (DMSP) AND THE NOAA POLAR-ORBITING OPERATIONAL ENVIRONMENTAL SATELLITE (POES) PROGRAM

D. COTTER, A. RAMSEY, E. HEACOCK, J. BAILEY, and O. WILKES Oct. 1985 416 p

(AD-A165118) Avail: NTIS HC A18/MF A01 CSCL 22B

This report offers technical comparison of the two United States operational space programs that are based on the capabilities of polar-orbiting environmental satellites. The U.S. Air Force manages and conducts the operations of the Defense Meteorological Satellite Program (DMSP); the National Oceanic and Atmospheric Administration has the same responsibilities with respect to the NOAA Polar-orbiting Operational Environmental Satellite (POES) program. The report examines the major missions and goals of the two programs, the management and operational procedures that they follow, and the support they extend to each other and to other Federal agencies. Detailed discussions are provided about the specifications and performance characteristics of the spacecraft, sensors, onboard systems, command and control systems, and communications systems employed by the two programs. An extensive relative analysis of the operation and uses of the DMSP and POES imaging and atmospheric sounding instruments is provided. Other sensors and systems are discussed, as is the joint agreement between DOD and NOAA for sharing their satellite data and data processing load. Nonmeteorological users of DMSP and POES data are described. The organization and content of the satellite data archive are presented. Near-future system improvements and longer-term mission requirements are also discussed. Author (GRA)

N86-28007# National Oceanic and Atmospheric Administration, Washington, D. C.

OPTIMUM MANAGEMENT STRATEGIES FOR THE NOAA (NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION) POLAR-ORBITING OPERATIONAL ENVIRONMENTAL SATELLITES, 1985-2000. VOLUME 1 Final Report

W. H. ESKITE and W. P. BISHOP Apr. 1985 70 p

(AD-A165143) Avail: NTIS HC A04/MF A01 CSCL 05A

The experience of the past 15 years was used as a basis to establish the best management principles to apply to the POES for the next 15 years. This was done for both a two-satellite configuration and a one-satellite configuration. The principles include always having a spare available, a 4-month call-up capability, taking advantage of satellites that live longer than their design life, and taking advantage of early indications of imminent failure. These principles must be applied in different ways to the two configurations. Applying these principles to several scenarios for the future leads to the conclusion that we should plan for 12 satellites for the next 15 years for either the one-satellite or the two-satellite system. Author (GRA)

N86-28016# National Oceanic and Atmospheric Administration, Washington, D. C.
INTERNATIONAL COORDINATION OF AND CONTRIBUTIONS TO ENVIRONMENTAL SATELLITE PROGRAMS Final Report
P. UHLIR and L. SHAFFER Jun. 1985 65 p
(AD-A165142) Avail: NTIS HC A04/MF A01 CSCL 22B

The paper begins with an overview of U.S. policy on remote sensing. Next, the extensive international cooperation in U.S. Polar-orbiting Operational Environmental Satellites (POES) is described. This includes participation in the POES direct readout services program, and existing instrument contributions and commitments to the POES system. The opportunities and mechanisms for future contributions to POES, or to the polar platform component of the U.S. Space Station, are also examined. Geostationary environmental satellites are operated by the United States, the European Space Agency, Japan, and India. These systems are described, and the Coordination on Geostationary Meteorological Satellites is discussed. Other international organizations used for cooperation and coordination in remote-sensing activities are outlined. These include the World Meteorological Organization, the Intergovernmental Oceanographic Commission, the International Council of Scientific Unions, and the Committee on Earth Observations Satellites. Contributions by the United States to planned foreign remote-sensing programs are addressed as well. Finally, the report identifies and discusses three trends in remote sensing, and makes some concluding observations about the future of international remote-sensing activities. Appendix A lists the dates of all relevant documents, such as Memoranda of Understanding, Terms of Reference for international committees, and Minutes of Meetings. GRA

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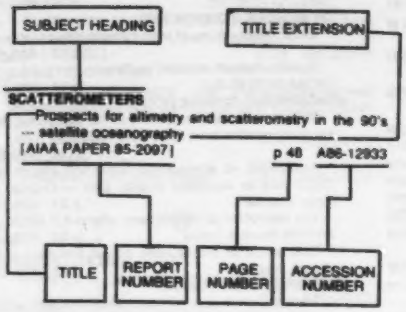

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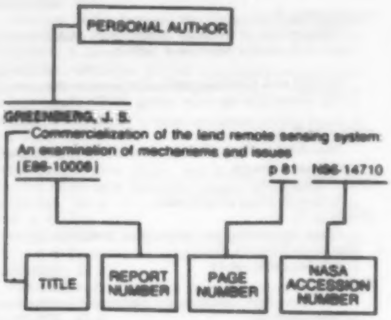

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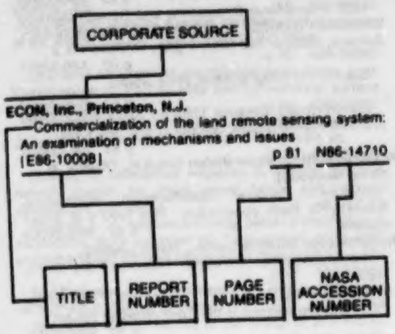
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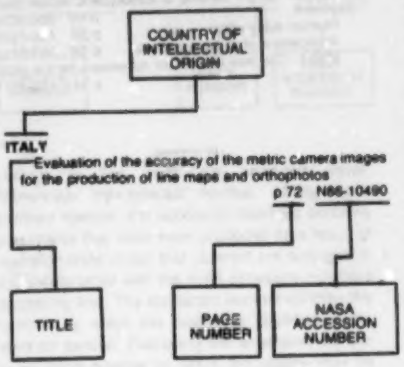
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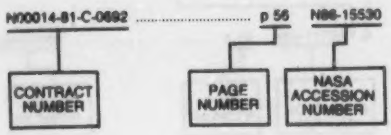

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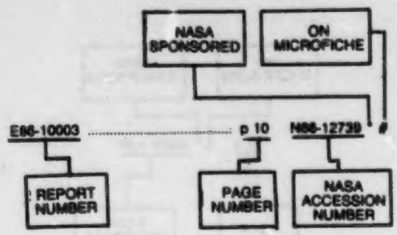

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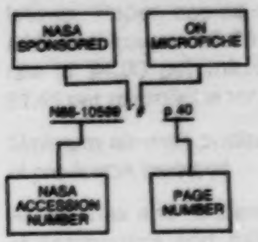

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16. Abstract

This bibliography lists 382 reports, articles and other documents introduced into the NASA scientific and technical information system between July 1 and September 30, 1986. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis.

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EARTH RESOURCES

A CONTINUING BIBLIOGRAPHY WITH INDEXES

Issue 52

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between October 1 and December 31, 1986 in

- ***Scientific and Technical Aerospace Reports (STAR)***
- ***International Aerospace Abstracts (IAA).***

NASA *Scientific and Technical Information Branch* 1987
National Aeronautics and Space Administration
Washington, DC

This bibliography was prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by RMS Associates.

INTRODUCTION

The technical literature described in this continuing bibliography may be helpful to researchers in numerous disciplines such as agriculture and forestry, geography and cartography, geology and mining, oceanography and fishing, environmental control, and many others. Until recently it was impossible for anyone to examine more than a minute fraction of the Earth's surface continuously. Now vast areas can be observed synoptically, and changes noted in both the Earth's lands and waters, by sensing instrumentation on orbiting spacecraft or on aircraft.

This literature survey lists 454 reports, articles, and other documents announced between October 1 and December 31, 1986 in *Scientific and Technical Aerospace Reports (STAR)*, and *International Aerospace Abstracts (IAA)*.

The coverage includes documents related to the identification and evaluation by means of sensors in spacecraft and aircraft of vegetation, minerals, and other natural resources, and the techniques and potentialities of surveying and keeping up-to-date inventories of such riches. It encompasses studies of such natural phenomena as earthquakes, volcanoes, ocean currents, and magnetic fields; and such cultural phenomena as cities, transportation networks, and irrigation systems. Descriptions of the components and use of remote sensing and geophysical instrumentation, their subsystems, observational procedures, signature and analyses and interpretive techiques for gathering data are also included. All reports generated under NASA's Earth Resources Survey Program for the time period covered in this bibliography are also included. The bibliography does not contain citations to documents dealing mainly with satellites or satellite equipment used in navigation or communication systems, nor with instrumentation not used aboard aerospace vehicles.

The selected items are grouped in nine categories. These are listed in the Table of Contents with notes regarding the scope of each category. These categories were especially chosen for this publication, and differ from those found in *STAR* and *IAA*.

Each entry consists of a standard bibliographic citation accompanied by an abstract. The citations include the original accession numbers from the respective announcement journals.

Under each of the nine categories, the entries are presented in one of two groups that appear in the following order:

IAA entries identified by accession number series A86-10,000 in ascending accession number order;

STAR entries identified by accession number series N86-10,000 in ascending accession number order.

After the abstract section, there are seven indexes:

subject, personal author, corporate source, foreign technology, contract number, report/accession number, and accession number.

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TYPICAL REPORT CITATION AND ABSTRACT

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ACCESSION NUMBER → **N86-12740*#** Kansas Univ. Center for Research, Inc., Lawrence. ← **CORPORATE SOURCE**
Remote Sensing Lab.
TITLE → **EVALUATION OF SPACE SAR AS A LAND-COVER CLASSIFICATION Final Report**
AUTHORS → B. BRISCO, F. T. ULABY, and T. H. L. WILLIAMS 1985 ← **PUBLICATION DATE** 123 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls S.D. 57198 ERTS
CONTRACT NUMBER → (Contract NCC9-7)
(E86-10004; NASA-CR-176267; NAS 1.26:176267; RSL-TR-605-1) ← **REPORT NUMBERS**
AVAILABILITY SOURCE → Avail: NTIS HC A06/MF A01 CSCL 02B ← **COSATI CODE**

The multidimensional approach to the mapping of land cover, crops, and forests is reported. Dimensionality is achieved by using data from sensors such as LANDSAT to augment Seasat and Shuttle Image Radar (SIR) data, using different image features such as tone and texture, and acquiring multidate data. Seasat, Shuttle Imaging Radar (SIR-A), and LANDSAT data are used both individually and in combination to map land cover in Oklahoma. The results indicates that radar is the best single sensor (72% accuracy) and produces the best sensor combination (97.5% accuracy) for discriminating among five land cover categories. Multidate Seasat data and a single data of LANDSAT coverage are than used in a crop classification study of western Kansas. The highest accuracy for a single channel is achieved using a Seasat scene, which produces a classification accuracy of 67%. Classification accuracy increases to approximately 75% when either a multidate Seasat combination or LANDSAT data in a multisensor combination is used. The tonal and textural elements of SIR-A data are then used both alone and in combination to classify forests into five categories. Author

TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

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AIAA ACCESSION NUMBER → **A86-15608*#** National Aeronautics and Space Administration, Washington, D.C.
TITLE → **BIOGEOCHEMICAL CYCLING IN TERRESTRIAL ECOSYSTEMS - MODELING, MEASUREMENT, AND REMOTE SENSING**
AUTHORS → D. L. PETERSON, P. A. MATSON, J. G. LAWLESS (NASA, Ames Research Center, Moffett Field, CA), J. D. ABER (Wisconsin University, Madison), P. M. VITOUSEK (Stanford University, CA) ← **AUTHOR'S AFFILIATION**
et al. IAF, International Astronautical Congress, 36th, Stockholm, ← **MEETING**
Sweden, Oct. 7-12, 1985. ← **MEETING DATE** 13 p. refs
REPORT NUMBER → (IAF PAPER 85-14)

The use of modeling, remote sensing, and measurements to characterize the pathways and to measure the rate of biogeochemical cycling in forest ecosystems is described. The application of the process-level model to predict processes in intact forests and ecosystems response to disturbance is examined. The selection of research areas from contrasting climate regimes and sites having a fertility gradient in that regime is discussed, and the sites studied are listed. The use of remote sensing in determining leaf area index and canopy biochemistry is analyzed. Nitrous oxide emission is investigated by using a gas measurement instrument. Future research projects, which include studying the influence of changes on nutrient cycling in ecosystems and the effect of pollutants on the ecosystems, are discussed. I.F.

EARTH RESOURCES

A Continuing Bibliography (Issue 52)

JANUARY 1987

01

AGRICULTURE AND FORESTRY

Includes crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventry, forest fire detection, and wildlife migration patterns.

A86-40006
PERFORMANCE EVALUATION OF A SATELLITE-BORNE SYNTHETIC APERTURE RADAR FOR SOIL MOISTURE MAPPING BY A COMPUTER SIMULATION TECHNIQUE
F. T. ULABY (Michigan, University, Ann Arbor) and M. FUJITA Radio Research Laboratory, Journal (ISSN 0033-8001), vol. 33, March 1986, p. 27-42. refs

In this paper, the ability of a satellite-borne synthetic aperture radar (SAR) to detect soil moisture is evaluated by means of a computer simulation technique. The computer simulation package includes the azimuth compression processing using a range-sequential processor. The results of computer simulations indicate that in estimating soil moisture content with a four-look processor, the difference between the assumed and estimated values of soil moisture is within + or - 20 percent of field capacity for 57 percent of the pixels for an agricultural flood-plain and for 50 percent of the pixels for a hilly terrain. The estimation accuracy for soil moisture may be improved by reducing the effect of fading by noncoherent averaging. Author

A86-40320* Delaware Univ., Newark.
REMOTE SENSING OF SPARTINA ANGLICA BIOMASS IN FIVE FRENCH SALT MARSHES
M. F. GROSS, V. KLEMAS, and J. E. LEVASSEUR International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, May 1986, p. 657-664. Sponsorship: Centre National pour l'Exploitation des Oceans. refs
(Contract CNEXO-83/7202; NAGW-374)

The utilization of regression models to estimate Spartina anglica biomass in marshes is studied. Radiance data for five S. anglica plots located along the coast of Brittany, France at 48 deg 40 min N between 1 deg 30 min W- 4 deg 30 min W was collected with a hand-held radiometer. Biomass data is derived from the radiance data, and the radiance and biomass data are employed in the formulation of simple regression models. The models are applied to the radiance data from the other four marshes. It is observed that the models predicted the biomass for all four marshes, and for three of the four marshes the estimated leaf and live biomass are within 1-13 percent of the harvest values. The effects of slit and dead tissues on the radiance from the S. anglica canopies are analyzed. It is noted that simple regression models which correlate radiance data to S. Anglica biomass in one marsh can be applied to the accurate prediction of leaf and live S. anglica biomass in other marshes. I.F.

A86-40321* State Univ. of New York, Binghamton.
ESTIMATION OF CANOPY PARAMETERS FOR INHOMOGENEOUS VEGETATION CANOPIES FROM REFLECTANCE DATA. I - TWO-DIMENSIONAL ROW CANOPY
N. S. GOEL and T. GRIER (New York, State University, Binghamton) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, May 1986, p. 665-681. NASA-supported research. refs

A canopy-reflectance (CR) model for row-planted vegetation is presented. Its use of an estimation of important biophysical variables like leaf-area index (LAI) and average leaf angle (ALA) from bidirectional CR data is discussed. Using field-measured CR data for a partially covered soybean canopy, it is shown that one can accurately estimate LAI, ALA and extent of percentage of ground cover from CR data. Author

A86-40322* California Univ., Santa Barbara.
PERFORMANCE ANALYSIS OF IMAGE PROCESSING ALGORITHMS FOR CLASSIFICATION OF NATURAL VEGETATION IN THE MOUNTAINS OF SOUTHERN CALIFORNIA
S. R. YOOL, J. L. STAR, J. E. ESTES, D. B. BOTKIN, D. W. ECKHARDT (California, University, Santa Barbara) et al. International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, May 1986, p. 683-702. Research supported by the University of California. refs
(Contract NAGW-455)

The earth's forests fix carbon from the atmosphere during photosynthesis. Scientists are concerned that massive forest removals may promote an increase in atmospheric carbon dioxide, with possible global warming and related environmental effects. Space-based remote sensing may enable the production of accurate world forest maps needed to examine this concern objectively. To test the limits of remote sensing for large-area forest mapping, we use Landsat data acquired over a site in the forested mountains of southern California to examine the relative capacities of a variety of popular image processing algorithms to discriminate different forest types. Results indicate that certain algorithms are best suited to forest classification. Differences in performance between the algorithms tested appear related to variations in their sensitivities to spectral variations caused by background reflectance, differential illumination, and spatial pattern by species. Results emphasize the complexity between the land-cover regime, remotely sensed data and the algorithms used to process these data. Author

A86-40823
DIGITAL REGIONAL CARTOGRAPHY FROM LANDSAT IMAGES AGRICULTURAL REGIONS IN THE KIAMBU DISTRICT (KENYA) [CARTOGRAPHIE REGIONALE NUMERIQUE A PARTIR D'IMAGES LANDSAT LES REGIONS AGRICOLES DU DISTRICT DE KIAMBU /KENYA/]
J. BARAZA, J.-P. ROGALA (Regional Centre for Services in Surveying, Mapping and Remote Sensing, Nairobi, Kenya), and G. SAVARY (IBM France, S.A., Centre Scientifique, Paris, France) Photo Interpretation (ISSN 0031-8523), vol. 23, July-Aug. 1984, p. 13-16. In English, French, and Spanish.

A digital analysis of the Kiambu district Landsat images is performed to provide agricultural survey zoning based on qualitative criteria. From the initial image, delineating such objects as forests, grain crops, bare ground, and grazing land, a second image is derived with pixels assigned to objects based on their radiometric properties. In the third image, regions are characterized by composition expressed in percentages of ground occupation types, and in the final image, zones are color indexed by the typical region represented. Digital processing of the last image involves successive analysis of all image points, with the neighborhood of each point consisting of a 44 x 44 pixel square. R.R.

A86-43962

VEGETATION MAPPING OF NOWITNA NATIONAL WILDLIFE REFUGE, ALASKA USING LANDSAT MSS DIGITAL DATA

S. S. TALBOT (U.S. Fish and Wildlife Service, Anchorage, AK) and C. J. MARKON (Technicolor Government Services, Inc., Anchorage, AK) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, June 1986, p. 791-799. refs

In connection with the Alaska National Interest Lands Conservation Act of 1980, the U.S. Fish and Wildlife Service has to identify and describe the wildlife habitats of the Nowitna National Wildlife Refuge (NWR). An examination of the considered habitats requires the employment of a suitable vegetation map. It is pointed out that the most practical approach to refuge vegetation mapping appears to be a Landsat-assisted approach. Specific objectives of the present report are related to the presentation of a Landsat-derived vegetation map showing the distribution of vegetation types within Nowitna NWR. In addition, a description of the variation in the physiognomy and composition of the vegetation in relation to broad ecological factors is provided. Attention is given to aspects of geographical setting, preprocessing, the development of training classes and associated statistics, spectral class labeling, classification, postclassification refinement, forest, scrub, dwarf scrub, herbaceous vegetation, water, and patterns. G.R.

A86-43964* Alaska Univ., Fairbanks.

COMPARISON OF LEAF AND CANOPY REFLECTANCE OF SUBARCTIC FORESTS

K. G. DEAN, Y. KODAMA, and G. WENDLER (Alaska, University, Fairbanks) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, June 1986, p. 809-811. refs (Contract NCA2-OR-020-401)

Near-surface and aerial reflectance of foliage and canopies of subarctic forests were measured in central Alaska near Fairbanks. Bi-directional and hemispherical radiometric data were recorded over wavelengths ranging from 0.285 to 2.8 microns with emphasis on Landsat TM (Thematic Mapper) bands. Comparison of near-surface and aerial data indicates that the canopy of some species such as black spruce and aspen have reflectance values similar to their respective foliage. Other species such as birch have large differences. Canopy structure and understory vegetation appear to be the primary factors that control whether the reflectance of canopy and foliage are similar or different. The results suggest that radiation reflected from the canopy of some forest species will be close to laboratory measurements of foliage after atmospheric corrections. Author

A86-44047

SURFACE TEMPERATURE AS AN INDICATOR OF EVAPOTRANSPIRATION AND SOIL MOISTURE

P. REINIGER (CEC, Directorate-General for Science Research and Development, Brussels, Belgium) and B. SEGUIN (Institut National de la Recherche Agronomique, Station de Bioclimatologie, Montfavet, France) Remote Sensing Reviews (ISSN 0275-7257), vol. 1, pt. 2, 1986, p. 277-310. refs

Results were reported from efforts to define numerical models for extracting evapotranspiration (ET) data from images generated by the Heat Capacity Mapping Mission (HCMM). The radiometer had a 500 x 500 m resolution, which was considered well-suited to ET studies. An energy balance equation was defined to relate the surface temperature and the evaporation. In a variation called the TERGRA model, account was taken of limitations imposed on ET by stomatal closure in periods of water stress. A TELL-US model was also devised for vegetation-sparse areas. The latter model required as input the daily minimum and maximum temperatures governing the diurnal pattern of surface temperature. Several other models are also described, and all model predictions are compared with in-situ data. It is found that effective assessments of ET requires several daytime-only temperature measurements and thorough accounting of atmospheric effects. M.S.K.

A86-44048

ASSOCIATION AMONG SURFACE TEMPERATURES SENSED BY SATELLITE AND AGRICULTURALLY RELATED VARIABLES

P. R. NIXON, C. L. WIEGAND, and A. J. RICHARDSON (USDA, Agricultural Research Service, Weslaco, TX) Remote Sensing Reviews (ISSN 0275-7257), vol. 1, pt. 2, 1986, p. 311-340. refs

Reflective (0.1-1.2 micron) and thermal IR (10.5-12.5 microns) data acquired by the Heat Capacity Mapping Mission over various crop areas in the Rio Grande Valley of Texas were compared with ground truth data for agricultural variables. The 480 m resolution satellite images were evaluated for usefulness in assessing crop water stress, temperature as affected by the plant canopy, freeze damage assessment, and cloud cover corrections. The data was also employed to generate aridity indices for the coverage areas. Attention was given to variations in the data for different crop types (sugarcane, citrus groves and sorghum). The study also covered synoptic scale temperature gradients inland from the coast, air temperatures for a 220 km wide area, and soil associations and vegetative cover. High correlations were found between the IR surface temperature data and the evapotranspiration rate. The IR data were also valuable for predicting the severity of freeze events for the crops. M.S.K.

A86-44160* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

MULTIPLE INCIDENCE ANGLE SIR-B EXPERIMENT OVER ARGENTINA MAPPING OF FOREST UNITS

J. CIMINO, D. CASEY, S. D. WALL (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), A. BRANDANI (CONICET; Centro de Geologia de Costas, Mar del Plata, Argentina), and J. RABASSA (Provincia de Buenos Aires, Comision de Investigaciones Cientificas de la Provincia, La Plata, Argentina) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 498-509. NASA-supported research. refs

Multiple incidence angle SIR-B data of the Cordon la Grasa region of the Chubut Province of Argentina are used to discriminate various forest types by their relative brightness versus incidence angle signatures. The region consists of several species of Nothofagas which change in canopy structure with elevation, slope, and exposure. In general, the factors that appear to impact the radar response most are canopy structure, density, and ground cover (presence or absence of dead trunks and branches in particular). The results of this work indicate that (1) different forest species, and structures of a single species, may be discriminated using multiple incidence angle radar imagery and (2) it is essential to consider the variation in backscatter due to incidence angle when analyzing the comparing data collected at varying frequencies and polarizations. Author

A86-44161*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE SIR-B OBSERVATIONS OF MICROWAVE BACKSCATTER DEPENDENCE ON SOIL MOISTURE, SURFACE ROUGHNESS, AND VEGETATION COVERS

J. R. WANG, J. C. SHIUE (NASA, Goddard Space Flight Center, Greenbelt, MD), E. T. ENGMAN (USDA, Agricultural Research Center, Beltsville, MD), M. RUSEK (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), and C. STEINMEIER (Freiburg, Universitaet, Freiburg im Breisgau, West Germany) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 510-516. refs

An experiment was conducted from an L-band SAR aboard Space Shuttle Challenger in October 1984 to study the microwave backscatter dependence on soil moisture, surface roughness, and vegetation cover. The results based on the analyses of an image obtained at 21-deg incidence angle show a positive correlatlion between scattering coefficient and soil moisture content, with a sensitivity comparable to that derived from the ground radar measurements reported by Ulaby et al. (1978). The surface roughness strongly affects the microwave backscatter. A factor of two change in the standard deviation of surface roughness height gives a corresponding change of about 8 dB in the scattering coefficient. The microwave backscatter also depends on the vegetation types. Under the dry soil conditions, the scattering coefficient is observed to change from about -24 dB for an alfalfa or lettuce field to about -17 dB for a mature corn field. These results suggest that observations with a SAR system of multiple frequencies and polarizations are required to unravel the effects of soil moisture, surface roughness, and vegetation cover. Author

A86-44162* Michigan Univ., Ann Arbor.

PRELIMINARY EVALUATION OF THE SIR-B RESPONSE TO SOIL MOISTURE, SURFACE ROUGHNESS, AND CROP CANOPY COVER

M. C. DOBSON and F. T. ULABY (Michigan, University, Ann Arbor) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 517-526. refs
(Contract JPL-956921; JPL-957191; NAS7-918)

Two predawn ascending data-takes by the Shuttle Imaging Radar-B (SIR-B) were used to evaluate the effects of surface roughness, crop canopy, and soil moisture on radar backscatter. The two images, separated by three days, were both obtained at 30-deg local angle of incidence, but with opposite azimuth viewing directions. The imagery was externally calibrated with respect to the radar backscattering coefficient sigma(0) via response to arrays of point and area-extended targets of known radar cross section. Three land-cover classes: (1) corn, (2) corn stubble and plowed bare soil, and (3) disked bare soil, soybeans, soybean stubble, alfalfa, and clover could be readily separated for either observation date on the basis of image tone alone. The dependence of sigma(0) on the surface roughness and canopy brightness inhibits the capability of SIR to globally estimate the near-surface soil moisture from the value of sigma(0) for single date observations, unless the surface roughness or canopy cover conditions are accounted for. However, within given ranges of these conditions, the sigma(0) was found to be highly correlated with the soil moisture. I.S.

A86-44164*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

FOREST CANOPY CHARACTERIZATION AND VEGETATION PENETRATION ASSESSMENT WITH SPACE-BORNE RADAR

M. IMHOFF, C. VERMILLION (NASA, Goddard Space Flight Center, Greenbelt, MD), M. STORY (Science Applications Research Corp., Greenbelt, MD), F. KHAN (Bangladesh Space Research and Remote Sensing Organization, Science and Technology Div., Dhaka), and F. POLCYN (Michigan, Environmental Research Institute, Ann Arbor) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 535-542. refs

Synthetic Aperture Radar (SAR) images from the National Aeronautics and Space Administration's Shuttle Imaging Radar-B mission were used to analyze the effects of radar incidence angle on information content and vegetation penetration. Three SAR data sets using incidence angles of 26, 46, and 58 deg were acquired over the mangrove jungles of Southern Bangladesh. The data sets were digitally processed using 3 x 3, 7 x 7, and 11 x 11 spatial filters and geometrically registered to a multisource-multilevel-corraborative data base consisting of Landsat data, forest map data, and in situ acquired forest enumeration and topographic information. Analyses revealed that significant vegetation 'penetration' was found at all angles, and that tree and canopy structural morphology may exert an influence on this phenomenon. Author

A86-44171* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

MICROWAVE PENETRATION AND ATTENUATION IN DESERT SOIL - A FIELD EXPERIMENT WITH THE SHUTTLE IMAGING RADAR

T. G. FARR, C. ELACHI (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), P. HARTL, and K. CHOWDHURY (Stuttgart, Universitaet, West Germany) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 590-594. NASA-supported research. refs

Receivers buried in the Nevada desert were used with the Shuttle Imaging Radar to measure microwave attenuation as a function of soil moisture in situ. Results agree closely with laboratory measurements of attenuation and suggest that penetration of tens of centimeters in desert soils is common for L-band (1.2-GHz) radar. Author

A86-44445#

RESULTS OF THE GROUP AGROMET MONITORING PROJECT (GAMP)

A. ROSEMA (Environmental Analysis and Remote Sensing, Ltd., Delft, Netherlands) ESA Journal (ISSN 0379-2285), vol. 10, no. 1, 1986, p. 17-41. refs
(Contract ESA-5228/83-D/JS(SC))

Meteosat and conventional meteorological data obtained by the Group Agromat Monitoring Project during the 1979 growing season have been successfully integrated to achieve continuous mapping and monitoring of rainfall, evapotranspiration, germination dynamics and biomass development in the Sahelian zone of Mali and Mauretania. The rainfall, evapotranspiration and biomass mapping results have been verified, and the germination and biomass mappings were based on Meteosat-derived ground information. A + or - 30 percent accuracy of rainfall mapping, based on Meteosat-derived cloud information, and a + or - 10 percent (0.5 mm) accuracy of evapotranspiration mapping, based on Meteosat-derived ground information, were obtained. The application of Meteosat data for the evaluation of soil water infiltration immediately after rainfall is shown by the mapping and analysis of thermal inertia. R.R.

A86-44672

REMOTE SENSING OF NATURAL OBJECTS FROM SALYUT-7 [DISTANTSIONNOE ZONDIROVANIE PRIRODNYKH OB'EKTOV SO STANTSII 'SALIUT-7']

L. A. RONZHIN and IU. L. RESHTOGA Geodeziia i Kartografiia (ISSN 0016-7126), April 1986, p. 19-27. In Russian. refs

The advantages of narrow-band remote sensing are illustrated by Salyut-7 observations of various land-types in the Soviet Union. Attention is given to investigations of ore-bearing regions, geological structures in a mountain-forest region, and crop fields. B.J.

A86-44674

THE USE OF SPACE REMOTE-SENSING DATA IN FORESTRY [ISPOL'ZOVANIE KOSMICHESKOI INFORMATSII V LESNOM KHOZIAISTVE]

V. I. SUKHIKH Geodeziia i Kartografiia (ISSN 0016-7126), April 1986, p. 30-36. In Russian. refs

A86-46051

ASP, ANNUAL MEETING, 51ST, WASHINGTON, DC, MARCH 10-15, 1985, TECHNICAL PAPERS. VOLUMES 1 & 2

Falls Church, VA, American Society of Photogrammetry, 1985. Vol. 1, 458 p.; vol. 2, 456 p. For individual items see A86-46052 to A86-46124.

Papers are presented on a comparison of adjustement methods when parameters exceed conditions, improving the interpretability of high-altitude color infrared photography for the inventory, monitoring, and management of wildland resources, a computerized technique for the comparison of remotely sensed data (COMPAR), and the development of a digital geographic database for determining irrigation water allocations. Also considered are a Landsat-generated predictive model for prehistoric archaeological sites, a comparison of Thematic Mapper simulation and Thematic Mapper data for urban environments, computer image correlation for the determination of camera station parameters, the development of a Permit Geographic Information System for coastal zone management, and the Landsat Thematic Mapper World Data Base. Other topics include the identification of linear features in agricultural landscapes through spatial analyses of Thermal Infrared Mutispectral Scanner data, calibration for radiometric measurements with nonwhite reflectance standards, upgrading the triangulation capacity of the Digicart system, and aerial monitoring of erosional characteristics to improve flood control and sediment management. Papers are also presented on the correction of stereomodel deformation in optic disk cup measurement, multimodel techniques in industrial photogrammetry, and Thematic Mapper crop spectral separability as determined by field radiometry. R.R.

A86-46058

USING REMOTELY SENSED DATA TO MAP VEGETATIVE COVER FOR HABITAT EVALUATION IN THE SAGINAW RIVER BASIN

R. S. LUNETTA (U.S. Army, Detroit, MI), R. G. CONGALTON, A. M. B. REKAS, and J. K. STOLL (U.S. Army, Engineer Waterways Experiment Station, Vicksburg, MS) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 88-97. refs

A86-46060

A COMPARISON OF STEREOSCOPIC AND MONOSCOPIC INTERPRETATIONS ON STANDARD ASCS AERIAL PHOTOGRAPHY

J. L. SMITH (Virginia Polytechnic Institute and State University, Blacksburg) and G. LONG (Continental Forest Industries, Allendale, SC) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 107-114.

Nine average tree height/pine basal area categories were stereoscopically and monoscopically interpreted on standard ASCS aerial photography. The accuracies of these visual categorizations were compared using field verifications and multivariate discrete analysis techniques. Monoscopic interpretations of the original nine category classification system and of the three height classes were significantly poorer than the corresponding stereoscopic interpretations. However, the two methods produced interpretation accuracies for the three basal area categories which could not be statistically distinguished. Author

A86-46069

RECOGNITION OF SOUTHERN PINE SPECIES ON SMALL-SCALE COLOR-INFRARED AERIAL PHOTOGRAPHY

D. L. EVANS, J. S. HUGHES, and P. Y. BURNS (Louisiana State University, Baton Rouge) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 204-211. refs

Color-infrared (CIR), 1:58,000 and 1:12,000-scale aerial photographs were used to produce timber type maps of selected compartments in the Kisatchie Ranger District of Kisatchie National Forest in Louisiana. Longleaf-slash and loblolly-shortleaf pine categories were readily interpreted by use of color and tonal characteristics on the 1:58,000-scale imagery flown on December 4 and 5, 1981. Although these two pine categories could not be distinguished on the 1:12,000-scale imagery flown on May 8, 1982, hardwoods were easily separated from pines. Additional CIR imagery flown on November 12, 1979 (1:130,000-scale) and March 22, 1984 (1:2,000-scale) exhibit the same photographic characteristics which made pine category separation possible. Apparently, low sun angle and stand and tree morphologic characteristics combine to produce a significant difference in reflective properties of the two pine groups. Verification plots were used to assess agreement between the type maps and field conditions. Of 122 plots, 108 were correctly identified, an approximate agreement of 89 percent. These findings strongly indicate that a combination of winter and late-spring CIR imagery may be most appropriate for production of accurate forest type maps of this region. Author

A86-46074

UNSUPERVISED CLUSTER ANALYSIS OF LANDSAT MSS DATA FOR INVENTORIES OF RAINED TROPICAL SAVANNA AGRICULTURE

D. W. HOWES (Eastern Kentucky University, Richmond, KY) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 243-252. refs

A86-46079

USE OF SPECTRAL REFLECTANCE TO CHARACTERIZE THE RESPONSE OF SOYBEAN TO OZONE STRESS

W. W. CURE (North Carolina State University, Raleigh) and A. S. HEAGLE (USDA, Raleigh, NC) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 294-301. refs

Exposure to ozone, a major component of photochemical air pollution, can injure leaves and reduce the yields of some crop plants. Field experiments to study the response of soybean and other crop species to ozone are presently being conducted at different locations in the U.S. using specially designed open-top field exposure chambers. At one site near Raleigh, NC, methods are being developed to use canopy reflectance as a nondestructive means of assessing the response of soybean to ozone stress. Characterization of the rate of senescence as the rate of change of reflectance at 560 and 620 nm appears most promising. A unique spectroradiometer system has been developed that allows overhead access to the plants in open-top chambers. Optical fibers, 50 to 60 meters in length, are extended to selected chambers from a monochromator and detector located in a small trailer on the edge of the field. A two-position, optical fiber switch allows light to be directed to the monochromator either from the plants or a standard reflecting surface. Author

A86-46081

REVISING AGRICULTURAL LAND USE MAPS BY DIGITAL CHANGE DETECTION ON LANDSAT DATA

R. S. MUSSAKOWSKI (Ministry of Natural Resources, Ontario Centre for Remote Sensing, Toronto, Canada) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 312-321.

A86-46082

IMPROVING THE INTERPRETABILITY OF HIGH-ALTITUDE COLOR INFRARED PHOTOGRAPHY FOR THE INVENTORY, MONITORING AND MANAGEMENT OF WILDLAND RESOURCES

R. R. COLWELL (Oregon State University, Corvallis) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 323-330. USDA-supported research. refs

A86-46083

AN ANALYSIS OF SIR-A IMAGERY FOR MAPPING SOILS IN THE LAS CRUCES AREA OF NEW MEXICO

W. L. TENG (National Air and Space Museum, Washington, DC) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 341-351. refs

The usefulness of Shuttle Imaging Radar (SIR-A) imagery for mapping soils was assessed in a study of the Las Cruces area of New Mexico. A contact photographic print of the SIR-A image was analyzed visually, and units were delineated based on variations in image tone, texture, and association. The SIR-A units were compared with published soil survey mapping units and landform units previously mapped by the author from panchromatic airphotos. In general, SIR-A image patterns correspond, regionally, to varying degrees of landscape dissection (more dissected areas are lighter-toned) and, locally, to differences in surface roughness (rougher areas are lighter-toned). In some smooth, dark-toned areas, the presence of coppice dunes is evident by their locally lighter tones. Arroyos are easily distinguished, due to their generally coarse-grained materials, and are enhanced where oriented orthogonally to the radar look direction. Some discrimination of grain sizes in the arroyos may be possible. Although mapping of soil units does not appear to be feasible at this time, the separation of different units is possible, particularly in areas of prominent topography. In general, information derived from the SIR-A image complements that from airphotos. Author

A86-46084* Autometric Corp., Inc., Falls Church, Va.

CROPLAND SOIL MOISTURE ESTIMATES DERIVED FROM DUAL POLARIZATION 1.66 CENTIMETER PASSIVE MICROWAVE IMAGERY FROM NIMBUS 7

P. H. HARDER (Autometric, Inc., Falls Church, VA) and M. J. MCFARLAND (Texas A&M University, College Station) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 352-361. Research supported by Texas A & M University and NASA. refs

A86-46087* National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.

IDENTIFICATION OF LINEAR FEATURES IN AGRICULTURAL LANDSCAPES THROUGH SPATIAL ANALYSES OF THERMAL INFRARED MULTISPECTRAL SCANNER DATA

R. E. PELLETIER (NASA, National Space Technology Laboratories, Bay Saint Louis, MS) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 381-390. refs

A86-46088* Wisconsin Univ., Madison.

THE UTILITY OF DUAL-POLARIZATION SYNTHETIC APERTURE RADAR IMAGERY FOR VEGETATION TYPE DISCRIMINATION IN JAMAICA

R. W. KIEFER (Wisconsin, University, Madison) and C. A. WESSMAN IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 393-403. refs
(Contract NGT-50-002-800)

A86-46099

THE EFFECT OF SURFICIAL PROPERTIES ON LITHOLOGICAL DISCRIMINATION USING MSS DIGITAL DATA - AN UPDATE

B. E. KIRACOFE (Synectics Corp., Rome, NY) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 518-527. refs

Current knowledge using machine perception needs to be combined with knowledge of the relationships which exist in the physical environment in order to identify structural methodologies for natural resources assessment. This paper will report on the continuing research using image processing technologies with Landsat MSS data to focus on the vegetative/lithologic relationships which exist within the Adirondack Mountains, NY. Author

A86-46101* Utah Univ., Salt Lake City.

AN INTEGRATED LANDSAT/ANCILLARY DATA CLASSIFICATION OF DESERT RANGELAND

K. P. PRICE, M. K. RIDD, and J. A. MEROLA (Utah, University, Salt Lake City) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 538-545. Research supported by the Utah Department of Agriculture. Previously announced in STAR as N85-15248.
(Contract NAGW-95)

Range inventorying methods using Landsat MSS data, coupled with ancillary data were examined. The study area encompassed nearly 20,000 acres in Rush Valley, UT. The vegetation is predominately desert shrub and annual grasses, with same annual forbs. Three Landsat scenes were evaluated using a Kauth-Thomas brightness/greenness data transformation (May, June, and August dates). The data was classified using a four-band maximum-likelihood classifier. A print map was taken into the field to determine the relationship between print symbols and vegetation. It was determined that classification confusion could be greatly reduced by incorporating geomorphic units and soil texture (coarse vs fine) into the classification. Spectral data, geomorphic units, and soil texture were combined in a GIS format to produce a final vegetation map identifying 12 vegetation types. Author

A86-46105

IMAGE PROCESSING FOR SURVEYING NATURAL VEGETATION - POSSIBLE EFFECTS ON CLASSIFICATION ACCURACY

S. R. YOOL, D. W. ECKHARDT, J. L. STAR, T. L. BECKING, and J. E. ESTES (California, University, Santa Barbara) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 595-603. refs

Scientists studying the biosphere are concerned that massive forest clearing will result in net carbon dioxide emissions to the atmosphere that would promote global warming and associated environmental effects. Data from sensors aboard orbiting spacecraft may facilitate the production of acurate world forest maps that are needed to evaluate this concern. It is important to understand the limits of satellite-borne sensor data and data processing techniques for world forest mapping. Tests of data processing approches using Landsat data from a complex forested scene in California show the relative performances of ratioing, filtering and principal components approaches. Untransformed channels appear to perform best overall. Performances for untransformed, ratioed and the principal components of Landsat data channels are comparable for forest classes having complete cover. Filtered Landsat data channels performed poorest overall, but perform best on select forest classes. Performance variability appears to be related to variations in background reflectance, surface illumination and spatial pattern by class. Author

A86-46106* National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.

MONITORING VEGETATION RECOVERY PATTERNS ON MOUNT ST. HELENS USING THERMAL INFRARED MULTISPECTRAL DATA

K. J. LANGRAN (NASA, National Space Technology Laboratories, Bay Saint Louis, MS) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 612-617.

The eruptions of Mount St. Helens created new surfaces by stripping and implacing large volumes of eroded material and depositing tephra in the blast area and on the flanks of the mountain. Areas of major disturbance are those in the blast zone that were subject to debris avalanche, pyroclastic flows, mudflows, and blowdown and scorched timber; and those outside the blast zone that received extensive tephra deposits. These zones represent a spectrum of disturbance types and intensities that can be indexed by temperature, impact force, and depth of subsequent deposition. This paper describes an application of NASA's Thermal Infrared Multispectral Scanner (TIMS) in monitoring vegetation recovery patterns in disturbed areas. Preliminary study results indicate a significant correlation between measured effective radiant temperature and vegetated/nonvegetated areas, percent vegetation cover, and vegetation type. Author

A86-46112
AERIAL PHOTO IDENTIFICATION OF FOREST HABITATS
WM. BEFORT and J. J. ULLIMAN (Idaho, University, Moscow) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 679-688. refs

To learn whether forest sites could be classified as to ecological habitat type by use of large-scale aerial sampling photography, 156 stands in northern Idaho and eastern Washington were photographed at scales around 1:1000. A type-identification key was assembled, and five interpreters were asked to assign habitat type labels to 111 stereophoto sample strips, representing 16 field-identified habitat types. A success rate of approximately 75 per cent was achieved. Extreme misclassifications were rare, and interpretations were highly correlated with the positions of the types along a bioclimatic gradient. Author

A86-46117
RESOURCE INVENTORY OF ONDO STATE (NIGERIA) BASED ON REGIONAL INTERPRETATION OF RADAR MOSAICS
P. O. ADENIYI (Lagos, University, Nigeria) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 755-765. refs

The development of an inventory of the land use/land cover for the State of Ondo, Nigeria is studied using X-band, 3-cm wavelength, real aperture, and 1:250,000 SLAR mosaics. The classification of the mosaics was based on vegetation of similar physiognomic characteristics and the mapping unit is a 3 mm minimum. Geomorphological and land use/land cover interpretations of the radar mosaics are described. The geomorphological analysis reveals eight geomorphological units, two in low land areas and six in areas underlain by metamorphic rocks. It is observed that the spatial distribution of land use/land cover is 62.33 percent agricultural land, 35.94 percent forest, 1.33 percent grassland/wooded-shrub land, and 0.09 percent built-up area. I.F.

A86-46122
RESEARCH OF MULTISPECTRAL VIDEO FOR REMOTE SENSING BY THE AGRICULTURAL RESEARCH SERVICE
P. R. NIXON (USDA, Agricultural Research Service, Weslaco, TX) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 854-859. refs

A86-46123* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STRESS ASSESSMENT AND SPECTRAL CHARACTERIZATION OF SUSPECTED ACID DEPOSITION DAMAGE IN RED SPRUCE (PICEA RUBENS) FROM VERMONT
B. N. ROCK and J. E. VOGELMANN (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 860-870. NASA-supported research. refs

The effects of acid deposition on Picea rubens are studied. The Picea rubens located at Camels Hump Mt., Mt. Ascutney, and Ripton, VT were analyzed using stress level evaluations, in situ spectral data, pressure bomb analysis, and aircraft sensors. Spruce stress per circular plot and percent spruce mortality are calculated. The relation between stress levels and elevation and exposure and weather patterns is examined. It is observed that variations in the reflectance curves of the foliage and branches are related to cellular health, the type of cellular arrangement, and the degree of leaf tissue hydration; the leaf and twig specimens from high stress sites are more reflective in the red portion of the visible and less reflective in the NIR portion of the spectrum. The pressure bomb data reveal that the xylem water tension is higher in specimens from high stress sites. It is noted that remote sensing permits discrimination and mapping of suspected acid deposition damage. I.F.

A86-47810#
CORRELATION OF METAL CONCENTRATION WITH ANOMALIES IN NARROW BAND MULTISPECTRAL IMAGERY OF THE VEGETATION RED REFLECTANCE EDGE
J. R. MILLER, E. W. HARE (York University, North York, Canada), R. A. NEVILLE, R. P. GAUTHIER, W. D. MCCOLL (Canada Centre for Remote Sensing, Ottawa) et al. IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 143-153. NSERC-supported research. refs

A geobotanical remote sensing experiment was conducted in the late summer of 1983 in northern Ontario over a known metal anomaly. Field data included measurements of vegetation spectral reflectance, in addition to collection of samples of soil and vegetation which were analyzed chemically to determine metal concentrations. Multispectral imagery was acquired with a five-channel pushbroom imager, known as MEIS II, configured with narrow band (3 nm bandwidth) interference filters to define the reflected vegetation radiance in the spectral region of the red reflectance edge. Preliminary analysis of the imagery, using an inverted Gaussian model for the red edge, is described. Author

A86-47821#
GEOBOTANICAL REMOTE SENSING OF HEAVY METAL STRESSED VEGETATION USING LANDSAT MSS DATA
C. BANNINGER (Institut fuer digitale Bildverarbeitung und Graphik, Graz, Austria) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 339-345. BMFWF-supported research. refs

Landsat MSS-derived radiance values and transformations from three different scene dates of a coniferous and a mixed coniferous-broadleaf forest situated in southeastern Austria show a close relationship with the copper, lead, and zinc content of the underlying soils. Landsat MSS bands 6 and 7 and the first principal component display generally strong negative correlations with respect to all three metals and their combinations and the three Landsat scene dates, whereas the ratio and normalized difference transformations employing MSS bands 5, 6, and 7 normally exhibit weaker and less consistent negative correlations. Ground, Landsat, and statistical data and results suggest that a reduction in canopy density associated with an increase in soil metal content is responsible for the observed decrease in canopy reflectance. Author

A86-47822*# California Univ., Berkeley.
ANALYSIS OF SUBSTRATE AND PLANT SPECTRAL FEATURES OF SEMI-ARID SHRUB COMMUNITIES IN THE OWENS VALLEY, CALIFORNIA
S. L. USTIN (California, University, Berkeley), B. N. ROCK (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), and R. A. WOODWARD (California, University, Davis) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 347-359. refs

Airborne Imaging Spectrometer (AIS) data were analyzed to deduce plant density and species composition in three semi-arid shrub-dominated communities of Owens Valley, CA, occurring on either a sand, granite alluvium, or basalt substrate. The high-spectral resolution AIS data were related to spectra obtained with field portable spectrometers, which in turn were related to plant and soil characteristics of the communities. Many of the dominant species have unique spectral features which permit their identification in AIS pixel images. The canopy-induced shadow may be a major factor influencing substrate spectral properties during fall and winter, because of low sun angles. Moreover, changes in spectral signatures following dormancy and leaf senescence tend to decrease contrasts between the plant community and the geologic substrate, also suggesting that fall and winter are a difficult time of year for spectral analyses. I.S.

A86-47826*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AERIAL DETECTION OF LEAF SENESCENCE FOR A GEOBOTANICAL STUDY
M. SCHWALLER (NASA, Goddard Space Flight Center, Greenbelt, MD) and S. J. TKACH (Phillips Petroleum Co., Bartlesville, OK) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 449-456. refs

A geobotanical investigation based on the detection of premature leaf senescence was conducted in an area of predominantly chalcocite mineralization of the Keweenaw Peninsula in Michigan's Upper Peninsula. Spectrophotometric measurements indicated that the region from 600 to 700 nm captures the rise in red reflectance characteristic of senescent leaves. Observations at other wavelengths do not distinguish between senescent and green leaves as clearly and unequivocably as observations at these wavelengths. Small format black and white aerial photographs filtered for the red band (600 to 700 nm) and Thematic Mapper Simulator imagery were collected during the period of fall senescence in the study area. Soil samples were collected from two areas identified by leaf senescence and from two additional sites where the leaf canopy was still green. Geochemical analysis revealed that the sites characterized by premature leaf senescence had a significantly higher median soil copper concentration than the other two areas. Author

A86-47838*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE DETECTION OF SOIL GEOCHEMICAL ANOMALIES FROM AN AIRCRAFT PLATFORM - EXAMPLES FROM THE VIRGINIA PIEDMONT
R. BELL (NASA, Goddard Space Flight Center, Greenbelt, MD) and C. S. EVANS (Maryland, University, College Park) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 577-583. refs

The use of remote-sensing data on forest leaf flush to identify areas with anomalously high soil heavy-metal concentrations is demonstrated using airborne Thematic Mapper Simulator (TMS) leaf-area-index data obtained over two sites in Virginia in spring 1983 and 1984. Mean-reflectance differences, especially in the 760-900-nm and 630-690-nm bands, corresponding to delayed leaf flush are found to be good indicators of higher heavy-metal concentration. Airborne and ground-based canopy-temperature measurements are also shown to be significantly higher in high-heavy-metal areas than in control areas. T.K.

A86-47842#
SOIL THERMAL INERTIA AND SENSIBLE AND LATENT HEAT FLUXES BY REMOTE SENSING
D. HO (IBM France, S.A., Paris) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 635-643. refs

A simulation model of the heat-exchange process on the surface and in the soil (Ho, 1985) has shown that the surface temperature cycle is insensitive to the lower boundary conditions and the initial soil temperature profile. This makes it possible to treat the soil in a steady-state model like a transmission-line problem. As a result, the ground conducting flux can be considered as a function of the surface temperature and thermal inertia. From the daily temperature cycle it is possible to estimate the instants at which the conducting flux vanishes. Using Meteosat and NOAA visible and infrared data for November 4 and 5, 1982 over a region south of Chott Djerid (Tunisia) it is found that the conducting flux vanishes at around 07:30 and 16:00 LT. The sensible and latent heat fluxes at these instants are equal to the net radiation. The thermal inertia is also estimated by searching for the time when the sensible and latent heat fluxes vanish. At that instant, around 03:30 LT in this test case, thermal inertia is only a function of the net radiation and surface temperature. The result shows that thermal-inertia and heat-flux maps can eventually be generated from remotely sensed data. Author

A86-47845*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LITHOLOGIC MAPPING IN A FORESTED REGION USING REMOTELY SENSED DATA
E. MASUOKA, R. BELL (NASA, Goddard Space Flight Center, Greenbelt, MD), D. KYLE, T. GARMAN, M. TUTTLE (Maryland, University, College Park) et al. IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 683-691. refs

Forest canopies over different sedimentary lithologies of valleys and ridges are composed of different dominant species and have significantly different reflectance and emittance. In a botanical survey of eighty-seven forest sites, sedimentary lithologies were found to differ in the species which dominate the forest canopy. Sandstone sites had abundant chestnut oak (Quercus prinus), black oak (Q. velutina), and northern red oak (Q. rubra). On shale sites chestnut oak, white oak (Q. alba), northern red oak and red pine (Pinus resinosa) were dominant. Limestone sites had a variable species composition with the most common species, northern red oak, white oak, and black locust (Robinia pseudocacia) accounting for only 30 percent of the total trees. Thematic Mapper Simulator (TMS) data obtained during the growing season were analyzed to determine if sandstones, shales, and limestones could be distinguished on the basis of forest-canopy reflectance. The observations compared in the analysis were means of the eight TMS bands for 10 x 10-pixel test sites selected from areas with complete canopy closure. In August imagery the three lithologies were separable based on differences in TMS band 3 (630-690 nm) and band 8 (10.4-12.5 microns). Author

A86-47846*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MAPPING DIVERSE VEGETATION WITH MULTICHANNEL RADAR IMAGES
J. P. FORD, D. E. WICKLAND, A. OCAMPO (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), and R. R. SHARITZ (Georgia, University, Aiken, SC) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 693-699. NASA-supported research.

Airborne-SAR, SIR-A, Seasat SAR, and Landsat TM images of the Savannah River Plant, a gently sloping area of South Carolina covered with diverse vegetation, are presented and briefly characterized. Preliminary results indicate that multiple-polarization images constructed from the airborne-SAR data give some indication of forest density and understory growth but do not permit discrimination between evergreen and deciduous forests. Heat-tolerant vegetation growing on sand bars in streams bearing thermal effluents from nuclear reactors on the site is found to have a distinguishing polarization signature. T.K.

A86-48395

REMOTE SENSING OF SHIFTING CULTIVATION AND GRAZING PATTERNS IN KENYA'S SEMI-ARID REGION

W. PHILIPSON (Cornell University, Ithaca, NY) and G. O. WAYUMBA ITC Journal (ISSN 0303-2434), no. 4, 1985, p. 261-267. refs

In a representative semi-arid region in Kitui district, Kenya, medium scale, multi-date, panchromatic black-and-white aerial photographs and Landsat MSS data were analyzed using various manual and computer-assisted methods. The manual methods included stereoscopic analysis of the aerial photographs, and positive/negative masking colour additive viewing and diazo processing of the Landsat images. The digital methods used with the Landsat data were supervised classification (minimum distance to mean and parallelepiped classifiers), with and without rationing and canonical transformation, unsupervised classification (clustering); and a combined supervised and unsupervised classification (controlled cluster). The merits of the various methods are described including an assessment of their applicability in semi-arid regions. Author

A86-48954

DETECTION OF SURFACE SOIL VARIATION USING HIGH-RESOLUTION SATELLITE DATA - RESULTS FROM THE U.K SPOT-SIMULATION INVESTIGATION

G. G. WRIGHT and R. V. BIRNIE (Macaulay Institute for Soil Research, Aberdeen, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, June 1986, p. 757-766. refs

A86-48956

AN EVALUATION OF SPOT-SIMULATION IMAGERY FOR LAND-USE MAPPING AND ECOLOGICAL INVESTIGATIONS IN UPLAND AREAS OF NORTHERN IRELAND

N. L. BETTS, M. M. CRUICKSHANK, and R. W. TOMLINSON (Belfast, Queen's University, Northern Ireland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, June 1986, p. 779-790.

A86-48958

SPOT-SIMULATION CAMPAIGN - A PRELIMINARY LAND-USE CLASSIFICATION FOR A 200/SQ KM RIVER CATCHMENT

C. I. ESSERY and D. N. WILCOCK (Ulster, University, Coleraine, Northern Ireland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, June 1986, p. 801-814. refs

A preliminary land-use classification of the River Main drainage basin has been produced using SPOT-simulation imagery. The most successful classification procedure was a band-3/band-2 ratio. The major problem of the imagery was the similarity between bogland vegetation and bare soil. This problem has been overcome by means of an edited box-classification and the resulting areal estimates of land-use have been found to agree closely with the known ground truth. The advantages and limitations of the SPOT system are discussed in the context of the Northern Ireland landscape. Author

A86-49480

SURVEYING CHINA'S AGRICULTURAL RESOURCES - PATTERNS AND PROGRESS FROM SPACE

S. A. MORAIN (New Mexico, University, Albuquerque) Geocarto International, no. 1, 1986, p. 15-24. refs

An agricultural remote sensing center was developed at Beijing Agricultural University (BAU) in order to assess, monitor, and tabulate China's agricultural production. The BAU is the main research center for developing techniques for crop yield and production estimation and resource analysis throughout the six agroeconomic zones of China. Three examples revealing the applicability of remote sensing to China's agricultural production are described. The studies include: (1) an aerial, small format camera assessment of panda bear habitats in Baoxing County; (2) an evaluation of land-use categories in Yixing County using Landsat MSS data; and (3) biomass assessment using geometrically uncorrected AVHRR data of Inner Mongolia. I.F.

A86-49481

THE USE OF REMOTE SENSING IN MAPPING AND MONITORING VEGETATIONAL CHANGE ASSOCIATED WITH BUSHFIRE EVENTS IN EASTERN AUSTRALIA

A. K. MILNE (New South Wales, University, Kensington, Australia) Geocarto International, no. 1, 1986, p. 25-32. refs

A86-49511

CONTRACTION OF A TREE-COVERED AREA ACCORDING TO SIMULATED LANDSAT AND SPOT IMAGES - A SIGN OF HOW THE SAHEL ADAPTS ITSELF TO DROUGHT [LA CONTRACTION DE LA SURFACE ARBOREE, D'APRES LES IMAGES LANDSAT ET SPOT SIMULEES - SIGNE D'ADAPTATION SAHELIENNE A LA SECHERESSE]

M.-F. COUREL (Centre d'Etudes et de Realisations Cartographiques et Geographiques, Paris, France) Photo Interpretation (ISSN 0031-8523), vol. 24, Jan.-Feb. 1985, p. 9-13, 15. In French, English, and Spanish.

A86-49602#

METHODICAL INVESTIGATIONS CONCERNING THE IDENTIFICATION AND MAPPING OF HEATH AREAS (INCLUDING TRANSITIONAL POPULATIONS AND SUCCESSION STAGES) IN SATELLITE IMAGES [METHODISCHE UNTERSUCHUNGEN ZUR IDENTIFIKATION UND KARTIERUNG VON HEIDEFLAECHEN /EINSCHLIESSLICH UEBERGANGSGESELLSCHAFTEN UND SUKZESSIONSSTADIEN/ IN SATELLITENAUFNAHMEN]

H. ROHDENBURG (Braunschweig, Technische Universitaet, Brunswick, West Germany) BMFT, Statusseminar ueber die Nutzung von Fernerkundungsdaten in der Bundesrepublik Deutschland, Garmisch-Partenkirchen, West Germany, Jan. 20-22, 1986, Paper. 16 p. In German. refs

A86-49603#

EMPLOYMENT OF REMOTE SENSING, IN CASES RELATED TO WATER, SOIL, AND LAND USE, WITHIN THE FRAMEWORK OF PROJECTS OF THE FEDERAL INSTITUTE FOR EARTH SCIENCES AND RAW MATERIALS [ANWENDUNG DER FERNERKUNDUNG AUF DEN GEBIETEN WASSER, BODEN UND LANDNUTZUNG IM RAHMEN VON PROJEKTEN DER BUNDESANSTALT FUER GEOWISSENSCHAFTEN UND ROHSTOFFE /BGR/]

W. KRUCK BMFT, Statusseminar ueber die Nutzung von Fernerkundungsdaten in der Bundesrepublik Deutschland, Garmisch-Partenkirchen, West Germany, Jan. 20-22, 1986, Paper. 9 p. In German.

Since the time when images provided by earth resources satellites became available, 'remote sensing' has become an important factor for the West German institute considered in this paper. The projects concerned with water, soil, and land use involve mainly dry areas of the earth. The investigations required are often very complex, and there is an interaction between aspects of water, soil, and land use. The activities involved are illustrated by providing a description of some specific projects which have been selected as examples for the conducted studies. The project Burkina Faso (Upper Volta), for instance, involved an evaluation of imagery provided by Landsat I and II. The information obtained is related to geology, mineral deposits, soil, land use, and hydrology. Other projects described were concerned with Tahoua, Niger, and an area in northern Syria. G.R.

A86-49609#
QUANTIFICATION OF LAND DEGRADATION IN DEVELOPING COUNTRIES WITH THE AID OF REMOTE SENSING METHODS [QUANTIFIZIERUNG DER LANDSCHAFTSDEGRADATION IN ENTWICKLUNGSLAENDERN MIT FERNERKUNDUNGSMETHODEN]
W. ENDLICHER (Erlangen-Nuernberg, Universitaet, Erlangen, West Germany) BMFT, Statusseminar ueber die Nutzung von Fernerkundungsdaten in der Bundesrepublic Deutschland, Garmisch-Partenkirchen, West Germany, Jan. 20-22, 1986, Paper. 15 p. In German. refs

In the study of the processes which lead to land degradation, an important aspect is related to a quantification of such a degradation. Such a 'quantification' is concerned with the degree of soil erosion observed in connection with various forms of land use or with the local and regional extension of land degradation. It is pointed out that remote sensing methods are best suited for a quantification of land degradation in the chorological and regional dimension. The correctness of such a conclusion is demonstrated, taking into account, as a study area, the coastal highlands of Central Chile. Land degradation in this area can be recognized on the basis of soil erosion observations and the appearance of the vegetation. Attention is given to a diachronic-comparative quantification of linear soil erosion in the chorologic dimension on the basis of aerial photographs, and the quantification of land degradation in the case of the regional dimension on the basis of Landsat MSS data. G.R.

A86-49718* Los Alamos National Lab., N. Mex.
RADIATION PHYSICS AND MODELLING FOR OFF-NADIR SATELLITE-SENSING OF NON-LAMBERTIAN SURFACES
S. A. GERSTL and C. SIMMER (Los Alamos National Laboratory, NM) Remote Sensing of Environment (ISSN 0034-4257), vol. 20, Aug. 1986, p. 1-29. DOE-sponsored research. refs
(Contract NASA ORDER S-10786-C)

The primary objective of this paper is to provide a deeper understanding of the physics of satellite remote-sensing when off-nadir observations are considered. Emphasis is placed on the analysis and modeling of atmospheric effects and the radiative transfer of non-Lambertian surface reflectance characteristics from ground-level to satellite locations. The relative importance of spectral, spatial, angular, and temporal reflectance characteristics for satellite-sensed identification of vegetation types in the visible and near-infrared wavelength regions is evaluated. The highest identification value is attributed to angular reflectance signatures. Using radiative transfer calculations to evaluate the atmospheric effects on angular reflectance distributions of vegetation surfaces, atmosphere-invariant angular reflectance features such as the 'hot spot' and the 'persistent valley' are identified. A new atmospheric correction formalism for complete angular reflectance distributions is described. A sample calculation demonstrates that a highly non-Lambertian measured surface reflectance distribution can be retrieved from simulated satellite data in the visible and near infrared to within about 20 percent accuracy for almost all view directions up to 60 deg off-nadir. Thus the high value of angular surface reflectance characteristics (the 'angular signature') for satellite-sensed feature identification is confirmed, which provides a scientific basis for future off-nadir satellite observations. Author

A86-49719
SAMPLE SIZE FOR GROUND AND REMOTELY SENSED DATA
P. J. CURRAN and H. D. WILLIAMSON (Sheffield, University, England) Remote Sensing of Environment (ISSN 0034-4257), vol. 20, Aug. 1986, p. 31-41. refs
(Contract NERC-GR/3/5096)

Sampled data are used to calibrate and determine the accuracy of both remotely sensed data and the products of remotely sensed data. The problems of achieving a balance between the size and the error of these samples are discussed at the level of the sites within the scene. Using an area of limestone grassland as an illustrative example, the sample size required to characterize a wide range of grassland fields was determined. With a maximum of 5-percent error at the 95-percent confidence level, the minimum sample size per field was noted to vary between 1-58 for ground radiometric and airborne multispectral scanner measurements, and 142-293 for green leaf area index measurements. The collection of such large sample sizes is unusual in remote sensing. It is concluded that there is a need for an increased awareness of the magnitude of the sampling error, and an attempt should be made to use the known spatial autocorrelation in the data to reduce the error for a given sample size. Author

A86-49763
THE EFFICIENCY OF THE UTILIZATION OF SPACE REMOTE-SENSING DATA IN FOREST MANAGEMENT [EFFEKTIVNOST' ISPOL'ZOVANIIA KOSMICHESKOI INFORMATSII V LESNOM KHOZIAISTVE]
V. V. EZHKOV, A. P. METALNIKOV, A. S. ISAEV, V. I. SUKHIKH, V. S. KUDRIAVTSEV (Gosudarstvennyi Komitet SSSR po Nauke i Tekhnike; Vsesoiuznoe Aerofotolesoustroitel'noe Ob'edinenie Lesproet; Ministerstvo Lesnogo Khoziaistva RSFSR, Moscow; AN SSSR, Institut Lesa i Drevesiny, Krasnoyarsk, USSR) et al. Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1986, p. 3-12. In Russian. refs

A86-49767
IDENTIFICATION OF REGIONAL FEATURES OF WESTERN SIBERIAN SWAMPS FROM SPACE IMAGERY [VYIAVLENIE REGIONAL'NYKH OSOBENNOSTEI BOLOT ZAPADNOI SIBIRI NA OSNOVE KOSMICHESKIKH SNIMKOV]
S. M. GOROZHANKINA (AN SSSR, Institut Lesa i Drevesiny, Krasnoyarsk, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1986, p. 29-37. In Russian. refs

A86-49771
REMOTE SPECTROMETRY METHODS FOR ASSESSING THE CONDITION OF WINTER RYE FIELDS AFTER WINTERING [DISTANTSIONNYE SPEKTROMETRICHESKIE METODY OTSENKI SOSTOIANIIA OZIMOI RZHI POSLE PEREZIMOVKI]
S. F. BUGA, E. A. IANOVSKAIA, A. F. IANOVSKII, and L. A. USHKEVICH (AN BSSR, Institut Fiziki, Minsk; Belorusskii Nauchno-Issledovatel'skii Institut Zashchity Rastenii, Priluki, Belorussian SSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1986, p. 71-76. In Russian. refs

A86-49773
THE POSSIBILITY OF USING IR DATA TO EVALUATE EVAPOTRANSPIRATION IN CROPS [VOZMOZHNOSTI ISPOL'ZOVANIIA DANNYKH IK-DIAPAZONA DLIA OTSENKI EVAPOTRANSPIRATSII POSEVOV SEL'SKOKHOZIAISTVENNYKH KUL'TUR]
A. A. FEOKTISTOV (Vsesoiuznyi Nauchno-Issledovatel'skii Tsentr AIUS-agroresursy, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1986, p. 94-99. In Russian. refs

N86-28490# GEC-Marconi Electronics Ltd., Chelmsford (England). Research Labs.
SAR FOR AGRICULTURE AND FORESTRY
S. QUEGAN, P. N. CHURCHILL (Hunting Surveys Ltd., Boreham Wood, England), A. WRIGHT, J. LAMONT, A. J. RYE, and J. W. TREVETT *In* ESA Proceedings of a Workshop on Thematic Applications of SAR DATA p 7-14 Dec. 1985
Avail: NTIS HC A06/MF A01

The data handling, system engineering and information extraction necessary for a land-use SAR are discussed. Data handling requires techniques for change detection and interpretation; in both areas present knowledge is inadequate. The lack of multitemporal SAR data and coordinated plant parameter data are a severe hindrance to the development of techniques and physical understanding. The present state of knowledge does not permit clear definition of the parameters for a land use SAR sensor, nor the requirement for ancillary data. Image interpretation is argued to be best carried out on a land-unit rather than pixel-by-pixel basis. Texture is shown to be a potential source of information independent of mean backscatter for land-cover.

Human and machine measures of texture can be shown to correspond. ESA

N86-28491# National Aerospace Lab., Amsterdam (Netherlands).

USE OF A SAR IN AGRICULTURE AND FORESTRY

G. J. L. NOOREN, J. C. A. VANDERLUBBE, E. P. W. ATTEMA (Technische Hogeschool, Delft, Netherlands), L. KRUL, tj066073, and G. P. DELOOR (Physics Lab. RVO-TNO, The Hague, Netherlands) *In* ESA Proceedings of a Workshop on Thematic Applications of SAR DATA p 15-20 Dec. 1985
(Contract ESA-5777/83-NL-MS)
Avail: NTIS HC A06/MF A01

Applications of SAR in agriculture and forestry were assessed, and classification and segmentation algorithms for SAR imagery were derived. Analysis suggests that for most of the applications, SAR imagery is inadequate. The segmentation algorithm is a bad estimator for field size, gives satisfactory results for field identification, and leads to accurate determination of field averaged pixel value. The performance improves when the number of looks is increased. The use of multitemporal data gives more improvement. The classifier is based on segments rather than pixels. For crop rotation detection, it gives a good result with a smaller training set than is usually required. The area determination is better than in the case of segmentation only. ESA

N86-28495# Hunting Geology and Geophysics Ltd., Boreham Wood (England).

LAND FEATURE EXTRACTION FROM SAR IMAGES

P. N. CHURCHILL, S. QUEGAN (Marconi Co. Ltd., Chelmsford, England), N. VECK, and J. W. TREVETT *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data p 51-55 Dec. 1985 Sponsored by ESA and British Government
Avail: NTIS HC A06/MF A01

The reliability and precision with which land features can be extracted from airborne and satellite borne SAR's are reviewed. The study demonstrates the benefits of combining optical with microwave sensors. The combination of different bands along the electromagnetic spectrum permits a greater depth of information to be analyzed. The combination of different ways of interacting with the vegetative canopy permits a wider analysis to be undertaken. Optical sensors tend to represent the reflection from the surface of the canopy, while active microwave sensors react with the structure of the canopy. ESA

N86-28498# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).

STUDY OF THE POTENTIAL OF SAR FOR CROP IDENTIFICATION AND MONITORING

T. LETOAN, C. KERR, H. LAUR, A. LOPES, R. TOUZI, A. K. FUNG (Texas Univ., Arlington.), J. M. DURAND (Centre National d'Etudes Spatiales, Toulouse, France), Y. KERR, and J. PERBOS *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data p 73-85 Dec. 1985
(Contract ESA-6153/NL-MS)
Avail: NTIS HC A06/MF A01

It is shown that classification of vegetation covers with SAR data is possible using spectral and, to a lesser extent, textural information. To fully demonstrate this potential for a wide range of crop and climatic conditions adapted SAR data sets must be available. They should be mainly multitemporal, multipolarisation (HH and VV) and/or multifrequency SAR images associated with detailed ground data. Progress in processing techniques must be made, in particular in filtering and segmentation methods. Extraction of vegetation parameters is possible. ESA

N86-30245# Hebrew Univ., Jerusalem (Israel). Inst. of Earth Sciences.

A PROCEDURE FOR EVALUATION OF DUST POTENTIAL IN DESERT TERRAINS

R. GERSON, S. GROSSMAN, and R. AMIT 1985 87 p
(Contract DAJA45-83-C-0041)
(AD-A166491) Avail: NTIS HC A05/MF A01 CSCL 08B

The evaluation of dust potential in hot deserts is based on the association of well defined dust bearing soils and surficial deposits with specific landforms. Thses landforms are readily identified on airphotos (and in many cases on topographic maps and space imagery). The user may follow a sequence of operations, from the selection of a target area through the identification of relevant landforms and associated soils/surficial deposits, to the evaluation of the content, composition and distribution of dust in these media. The accompanying report is essential for the proper use of this procedure. GRA

N86-30933*# Foldes, Inc., Wayne, Pa.

A DESIGN STUDY FOR THE USE OF A MULTIPLE APERTURE DEPLOYABLE ANTENNA FOR SOIL MOISTURE REMOTE SENSING SATELLITE APPLICATIONS Final Report

P. FOLDES Aug. 1986 208 p
(Contract NAS1-17209)
(NASA-CR-178154; NAS 1.26:178154) Avail: NTIS HC A10/MF A01 CSCL 09A

The instrumentation problems associated with the measurement of soil moisture with a meaningful spatial and temperature resolution at a global scale are addressed. For this goal only medium term available affordable technology will be considered. The study while limited in scope, will utilize a large scale antenna structure, which is being developed presently as an experimental model. The interface constraints presented by a singel Space Transportation System (STS) flight will be assumed. Methodology consists of the following steps: review of science requirements; analyze effects of these requirements; present basic system engineering considerations and trade-offs related to orbit parameters, number of spacecraft and their lifetime, observation angles, beamwidth, crossover and swath, coverage percentage, beam quality and resolution, instrument quantities, and integration time; bracket the key system characteristics and develop an electromagnetic design of the antenna-passive radiometer system. Several aperture division combinations and feed array concepts are investigated to achieve maximum feasible performacne within the stated STS constraints. B.G.

N86-31084# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.

THE X-SAR SCIENCE PLAN

H. OETTL and F. VALDONI (Consiglio Nazionale delle Ricerche, Rome, Italy) Nov. 1985 165 p
(DFVLR-MITT-85-17; ISSN-0176-7739; ETN-86-97451) Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 32

Use of the X-SAR/SIR-C radar for geology, hydrology, oceanography, ice and snow cover, and vegetation remote sensing are discussed. ESA

N86-31092# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

VEGETATION

A. J. SIEBER, F. POSA (Bari Univ., Italy), and M. RICOTTILLI (Consiglio Nazionale delle Ricerche, Rome, Italy) *In its* The X-SAR Science Plan p 133-155 Nov. 1985
Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 32

Economic and technical advantages of X-SAR/SIR-C remote sensing of vegetation and land use are discussed. Investigations for the X-SAR mission are summarized: Radar response as function of biophysical properties of crops; crop type identification; phenological evaluation; vegetation stress conditions; vegetation indexes, rangeland assessment; and synergic effects of combining optical and SAR data for identifying and characterizing crop cover. ESA

N86-31941*# California Univ., Santa Barbara. Dept. of Geography.
COVER PROJECT AND EARTH RESOURCES RESEARCH TRANSITION Final Technical Report
D. B. BOTKIN and J. E. ESTES, principal investigators 1986 46 p
(Contract NCC9-13)
(NASA-CR-177176; NAS 1.26:177176) Avail: NTIS HC A03/MF A01 CSCL 05B

Results of research in the remote sensing of natural boreal forest vegetation (the COVER project) are summarized. The study objectives were to establish a baseline forest test site; develop transforms of LANDSAT MSS and TM data for forest composition, biomass, leaf area index, and net primary productivity; and perform tasks required for testing hypotheses regarding observed spectral responses to changes in leaf area index in aspen. In addition, the transfer and documentation of data collected in the COVER project (removed from the Johnson Space Center following the discontinuation of Earth resources research at that facility) is described. M.G.

N86-31971# European Space Agency, Paris (France).
CALIBRATION OF MULTISPECTRAL SCANNER (MSS) SATELLITE DATA TO EVALUATE CHANGE IN THE REFLECTION OF CONIFEROUS STOCKS
G. P. FEHLERT Nov. 1985 180 p Original language document was announced as N86-10636
(ESA-TT-938; DFVLR-FB-84-44; ETN-86-97575) Avail: NTIS HC A09/MF A01; original German version available from DFVLR, Cologne, West Germany DM 71

A relative calibration was performed in order to allow a comparative, multitemporal analysis of MSS satellite data and hence the detection of reflectory changes with regard to selected object classes. By applying the method to the class wood, the age of a coniferous stock can be determined, and during the stage of growth distinct age groups show locally differing reflection properties. The latter suggests disorders of the proliferation of young sprouts. This method can be an early indicator for the detection of damaged forest areas. The atmospheric influence on satellite data was determined by a multilayer atmospheric model. ESA

N86-32828*# Environmental Research Inst. of Michigan, Ann Arbor. Applications Div.
A FUELWOOD PLANTATION SITE SELECTION PROCEDURE USING GEOGRAPHIC INFORMATION SYSTEM TECHNOLOGY: A CASE STUDY IN SUPPORT OF THE NASA GLOBAL HABITABILITY PROGRAM Final Report, 1 Feb. 1985 - 30 Jun. 1985
N. E. G. ROLLER, J. E. COLWELL, and A. N. SELLMAN Jul. 1985 39 p
(Contract NASW-3852)
(NASA-CR-179704; NAS 1.26:179704; ERIM-173900-2-F) Avail: NTIS HC A03/MF A01 CSCL 02F

A study undertaken in support of NASA's Global Habitability Program is described. A demonstration of geographic information system (GIS) technology for site evaluation and selection is given. The objective was to locate potential fuelwood plantations within a 50 km radius of Nairobi, Kenya. A model was developed to evaluate site potential based on capability and suitability criteria and implemented using the Environmental Research Institute of Michigan's geographic information system. Author

N86-32829*# Delaware Univ., Newark. College of Marine Studies.
EVALUATION OF SPATIAL, RADIOMETRIC AND SPECTRAL THEMATIC MAPPER PERFORMANCE FOR COASTAL STUDIES Quarterly Status and Technical Progress Report, 1 Jul. - 30 Sep. 1984
V. KLEMAS 1985 4 p
(Contract NAS5-27580)
(NASA-CR-177149; NAS 1.26:177149) Avail: NTIS HC A02/MF A01 CSCL 08B

The main emphasis of the research was to determine what effect different wetland plant canopies would have upon observed reflectance in Thematic Mapper bands. The three major vegetation canopy types (broadleaf, gramineous and leafless) produce unique spectral responses for a similar quantity of live biomass. Biomass estimates computed from spectral data were most similar to biomass estimates determined from harvest data when models developed for a specific canopy were used. In other words, the spectral biomass estimate of a broadleaf canopy was most similar to the harvest biomass estimate when a broadleaf canopy radiance model was used. Work is continuing to more precisely determine regression coefficients for each canopy type and to model the change in the coefficients with various combinations of canopy types. Researchers suspect that textural and spatial considerations can be used to identify canopy types and improve biomass estimates from Thematic Mapper data. Author

N86-32830# European Space Agency, Paris (France).
MICROWAVE REMOTE SENSING APPLIED TO VEGETATION
W. R. BURKE, comp. Jan. 1985 159 p EARSeL Workshop held in Amsterdam, Netherlands, 10-12 Dec. 1984
(ESA-SP-227; ISSN-0379-6566; ETN-86-95054) Avail: NTIS HC A08/MF A01

Two approaches to radar signal processing for remote sensing are reviewed. The first considers the microwave region as just another window to be used in combination with the ones already existing in other wavelength regions. The second tries to solve the problem by fundamental investigations in the interaction between microwaves and remote sensing objects. ESA

N86-32832# Sheffield Univ. (England). Dept. of Geography.
ACTIVE MICROWAVE MAPPING OF VEGETATION
G. M. FOODY *In* ESA Microwave Remote Sensing Applied to Vegetation p 15-23 Jan. 1985
Avail: NTIS HC A08/MF A01

Per pixel and per field sampling methodologies for land cover mapping are compared. As a result of the changing viewing geometry, land cover map accuracy is found to be low and spatially variable. In an area of flat terrain land cover map accuracy is increased by allowing for the variations in viewing geometry by dividing the image into sectors defined by range distance and treating each sector independently. Using SAR 580 data, it is found that the use of tonal and textural information collected on a per field basis for a sectored image gives the highest land cover map accuracy. However, land cover map accuracy remains spatially variable. ESA

N86-32833# Hunting Geology and Geophysics Ltd., Boreham Wood (England).
A REVIEW OF RADAR ANALYSIS OF WOODLAND
P. N. CHURCHILL, A. I. D. HORNE (Forestry Commission, Farnham (England).), and R. KESSLER (Freiburg Univ. (West Germany).) *In* ESA Microwave Remote Sensing Applied to Vegetation p 25-32 Jan. 1985
(Contract ESTEC-5778/83/NS-MS)
Avail: NTIS HC A08/MF A01

The ability of satellite imaging radar to make woodland determination is assessed, and the optimum radar parameters required are reviewed. Imagery and methods used in the analysis of imaging radar data of woodland are discussed. Imaging radar demonstrates great potential in making woodland determinations, but insufficient data exists to ascertain its full potential and to

fully define optimum system parameters for the analysis of woodland. More work is needed to eliminate speckle and to incorporate texture or pattern measures in machine classification.
ESA

N86-32839# Freiburg Univ. (West Germany). Abt. Luftbildmessung und Fernerkundung.
SOME PRELIMINARY RESULTS ON LAND USE EVALUATIONS BY TEXTURE ANALYSIS OF SAR-580 DATA OVER THE TEST SITE FREIBURG (WEST GERMANY)
R. KESSLER and R. WALTENSPIEL *In* ESA Microwave Remote Sensing Applied to Vegetation p 85-91 Jan. 1985
Avail: NTIS HC A08/MF A01

Texture investigations of digital SAR-50 data in X-HH are described. Forest and agricultural sites were tested with a texture analysis program which informs about the statistical distribution of radar reflection intensities. The results show textural properties of the sites by demonstrating the statistical variations of backscatter intensity graphs along an adjustable boundary, which is located parallel to the mean intensity value.
ESA

N86-32840# Royal Aircraft Establishment, Farnborough (England). National Remote Sensing Centre.
SAR IMAGE SEGMENTATION USING DIGITISED FIELD BOUNDARIES FOR CROP MAPPING AND MONITORING APPLICATIONS
M. G. WOODING *In* ESA Microwave Remote Sensing Applied to Vegetation p 93-98 Jan. 1985
Avail: NTIS HC A08/MF A01

The use of digitized field boundary data to segment images into fields which are treated as separate units for backscatter measurement and image classification in SAR surveys of agricultural regions is discussed. The technique is demonstrated with the analysis of SAR 580 data for the GB6 test site in England. Digitized field boundaries are overlain on SAR 580 images geometrically corrected to fit the UK National Grid. Image analysis includes the preparation of images showing mean backscatter values for individual fields, the measurement of backscatter for different crop types, and the analysis of changes in backscatter on different imaging dates. Relationships between backscatter and ground data are examined in the context of crop mapping and monitoring crop growth.
ESA

N86-32841# Wageningen Agricultural Univ. (Netherlands). Dept. of Land Surveying and Remote Sensing.
TEXTURE ANALYSIS OF SLAR IMAGES AS AN AID IN AUTOMATED CLASSIFICATION OF FORESTED AREAS
D. H. HOEKMAN *In* ESA Microwave Remote Sensing Applied to Vegetation p 99-109 Jan. 1985
Avail: NTIS HC A08/MF A01

Experiments to elucidate the usefulness and behavior of statistical texture measures derived from gray level co-occurence and gray level difference counts in forest classification from SLAR imagery were performed. A fine resolution SLAR image of a forest with stands of tree species in the pole phase together with mature beach forests occurring in various spatial structures related to canopy roughness was analyzed. The measures reveal the potential to discriminate these forest structures. An integral classification approach for forests is suggested.
ESA

N86-32842# Canada Centre for Remote Sensing, Ottawa (Ontario).
MICROWAVE REMOTE SENSING OF AGRICULTURAL CROPS IN CANADA
J. CIHLAR, R. J. BROWN, and B. GUINDON *In* ESA Microwave Remote Sensing Applied to Vegetation p 113-120 Jan. 1985
Avail: NTIS HC A08/MF A01

Crop classification accuracies achieved with SAR, visible, and IR data; crop and soil parameters affecting SAR images; the procedures for digital SAR image analysis; and the relationship between airborne SAR data and satellite SAR data are discussed. Developments in ground and airborne microwave instrumentation for agricultural studies are presented, and research activities are outlined.
ESA

N86-32846# Dundee Univ. (Scotland). Lab. of Physics.
THE PHYSICAL BASIS OF REMOTE SENSING
J. M. ANDERSON *In* ESA Remote Sensing Applications in Civil Engineering p 1-7 Mar. 1985
Avail: NTIS HC A06/MF A01

Remote sensing by passive methods, whereby the surface of interest is the source of the radiation reaching the detector; passive methods whereby the Sun or other natural source provides the radiation reflected towards the detector; and active methods, whereby a magnetron, laser, or other man-made source provides the radiation reflected towards the detector is introduced. The theory of electromagnetic radiation in the visible/near infrared, and thermal infrared regions necessary for passive methods is outlined. Surface effects and detection systems are discussed.
ESA

N86-32847# Stirling Univ. (Scotland).
THE PHYSICAL BASIS OF REMOTE SENSING
A. I. WATSON *In* ESA Remote Sensing Applications in Civil Engineerig p 9-13 Mar. 1985
Avail: NTIS HC A06/MF A01

The changes that occur in electromagnetic radiation and matter when they interact, exploited in remote sensing, are described. Emission sources, transmission, reflectance, detectors, remote sensing systems, and system assessment criteria are discussed.
ESA

N86-32870# National Aerospace Lab., Amsterdam (Netherlands). Space Div.
SEMI-OPERATIONAL IDENTIFICATION OF AGRICULTURAL CROPS FROM AIRBORNE SLAR DATA
P. BINNENKADE, H. W. J. VANKASTEREN, and D. UENK 26 Mar. 1985 11 p Presented at 11th Intern. Symposium on Machine Processing of Remotely Sensed Data, West Lafayette, Ind., 25-27 Jun. 1985 Previously announced in IAA as A86-37025
(NLR-MP-85030-U; B8665118; ETN-86-97674) Avail: NTIS HC A02/MF A01

Preprocessing, segmentation, and pseudo-hierarchical classification of a multitemporal data set of three test sites for identification of potatoes and other agricultural crops is described. Good discrimination capabilities between crop types, especially potatoes, is achieved. Unique identification of the three major crop types (sugar beets, potatoes and winter wheat) with an accuracy greater than 90% is possible. In one area, this accuracy is obtained when using only the July data set. It appears possible to identify more than one species of winter wheat and potatoes. Oats and barley are difficult to distinguish from other crop types. It is possible to obtain the required results with a high and a low track in July and one other run in May.
ESA

N86-32872# Instituut voor Culturtechniek en Waterhuishouding, Wageningen (Netherlands).
REMOTE SENSING STUDY PROJECT IN OOST-GELDERLANDS (NETHERLANDS) Final Report [REMOTE SENSING STUDIEPROJECT OOST GELDERLAND]
Sep. 1985 65 p In DUTCH
(NOTA-1641; ETN-86-97495) Avail: NTIS HC A04/MF A01

Possibilities of operational applications of remote sensing (RS) recording and processing techniques for agriculture and nature areas were investigated. Information about water consumption of vegetation covering, soil moisture supply, crop production, the composition of natural vegetation, and the occurrence of agricultural crops was obtained in rural areas and peat colonies in the summer. Scanner recorded reflection and heat images and false color photographs were used. A vegetational description and an evapotranspiration map were composed using the automatic processing of digital reflection and heat images. The application of a combination of RS and conventional techniques leads to better results than the separate use of one of the techniques. ESA

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ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

Includes land use analysis, urban and metroplitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.

A86-43516#

A CLASSIFICATION FOR URBAN LAND COVERAGE USING AIRBORNE MULTI-SPECTRAL SCANNER IMAGE

A. HOYANO, Y. URANO, Y. MINAMIKAWA, and M. KATO (Kyushu University, Fukuoka, Japan) Kyushu University, Technology Reports (ISSN 0023-2718), vol. 59, Jan. 1986, p. 105-112. In Japanese, with abstract in English.

Aspects of urban land coverage are the most important information for investigating the urban thermal environment. This paper deals with an effective method of classification of land coverage using airborne multispectral scanner images with high visibility of 2 x 2 m ground objects. A pixel-by-pixel maximum likelihood method was used for supervised classification. Three training data files for land coverage categories were compiled with regard to both land coverage and land use and the characteristics of each type of training data were clarified. Clear classification results were obtained among 13 categories which are basic components of urban structure: buildings, pavements, vegetation, etc. Furthermore, the following items were discussed: (1) significant channels of the MSS image, (2) effects of ground visibility of MSS image on classification results, and (3) comparison with other classification methods. Author

A86-45705#

SPACE AGE LESSONS ABOUT OUR ENVIRONMENT

H. FRIEDMAN Aerospace America (ISSN 0740-722X), vol. 24, July 1986, p. 26-30.

A comprehensive discussion is presented on the implications of the complete atmospheric, climatological and vegetation cover data obtained to date by advanced sensor technologies and analysis methods. Attention is given to the reduction of ozone by chlorofluorcarbons and nitrogen oxides, the anthropogenic CO2-based greenhouse-effect warming trend, greenhouse warming consequences for rainfall patterns and continental vegetation cover distributions, and the contribution of methane to the greenhouse effect. Landsat Thematic Mapper and Very High Resolution Radiometer data for these phenomena are now being supplemented by the European SPOT remote sensing satellite. O.C.

A86-46057

DELINEATING PORT-RELATED PROCESSING AND FABRICATION LAND USE NORTHWEST OF PORT BALTIMORE USING A REMOTE SENSING BASED GEOGRAPHIC INFORMATION SYSTEM

T. D. MORELLI (DMA, Hydrographic/Topographic Center, Washington, DC) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 78-87. refs

A86-46062

USE OF THEMATIC MAPPER DATA TO UPDATE THE LAND COVER LAYER IN A DATA BASE FOR ELECTRIC POWER GENERATION FACILITIES

D. A. MILLER, G. M. BAUMER, B. J. TURNER (Pennsylvania State University, University Park), and D. Y. HEIVLY (Pennsylvania Power and Light Co., Allentown) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 128-136.

Landsat-4 TM data were used to generate vegetation/land cover classification maps for the Pennsylvania Power and Light Company. Preprocessing, analysis and display of the digital data was performed by the Office for Remote Sensing of Earth Resources (ORSER) digital image processing system. Final classified maps were produced by applying a Euclidean distance classifier to selected signatures for vegetation and land cover produced using a combination of unsupervised and supervised techniques. Maps created on a scale of 1:24,000 were composited with USGS 7-1/2 minute quadrangle maps, and were compared to existing aerial photographs and Environmental and Land-Use Data System maps. Good geographical precision was found, though the increased spatial resolution of the data significantly increased the spectral variability found in the scene, resulting in difficult classification for urban fringe areas and mixed residential agricultural areas. R.R.

A86-46064

LANDSAT TECHNIQUES DEVELOPMENT FOR AN INDUSTRIAL SITE OF GABUN-PARACALE MINING PROJECT

A. A. NAVARRO (Gabun-Paracale Mining Co., Inc., Manila, Philippines) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 147-151.

In the coming decades of the 20th century, Landsat surveying and mapping will be much needed by developing countries. In the sense that large industrial sites development should be located near the natural resources that they should use for their own raw materials in order to make the availability of this strategic resources for their own industrialization needs. In our own inventorying and raw material needs the geobotanical methods have been used, as well as electroscanning devices or 'footprint' methods by laser beam soil reflectance. And the most simplest is the degree of luminescence coefficient using computational activities in the industrial site pixel to determine the quality of industrial deposits in the mineralized regions for industrial plant locations. Author

A86-46072

SURVEYING AND AUTOMATIC MAPPING OF SAO PAULO STATE, BRAZIL - A GEOGRAPHIC INFORMATION SYSTEM WITH EMPHASIS OF LAND USE

R. S. FILHO, A. C. CAVALLI (TerraFoto S/A, Sao Paulo, Brazil), and H. S. PINTO (Campinas, Universidade Estadual, Brazil) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 229-236. refs

The State of S. Paulo is a region of some 250,000 sq km situated in southeastern Brazil. As a tropical area is shows extreme variation in geographical information, providing government and private campanies with a large amount of data which, despite being available, are not organized or standardized in the greatest part of the existing files. In the development of applied projects in areas of Land Use Monitoring, Production Forecasts, and Field Surveys, etc., a system called 'State System for Geographical Information' is being developed, to concentrate all kinds of geographical data in a data bank of an INTERGRAPH System. The basic information will be recorded as a grid of 1,000,000 points, referred to UTM coordinates, each one being an 'address' for up to 63 levels of data attributes. It is supposed that the ability of the computer for transferring information from a grid to a polygon basis and vice-versa, allied to a sampling model to be used in the field, will result in a fast and cost effective system with very low index of error. Author

02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

A86-46078

DEVELOPMENT OF A PERMIT GEOGRAPHIC INFORMATION SYSTEM FOR COASTAL ZONE MANAGEMENT

J. M. HILL, D. L. EVANS (Louisiana State University, Baton Rouge), and J. B. BLACKMON (Louisiana State, Dept. of Natural Resources, Baton Rouge) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 284-293. refs

A Permit Geographic Information System (PGIS), capable of such functions as multiple map comparison and manipulation, area calculation and tabulation, and textual documentation, is developed for the Louisiana Department of Natural Resources. The system is demonstrated using a modified version of NASA's ELAS, and mapped data sets, consisting of land/water, shoreline length and density, and comparison maps, are in a 50-by-50 meter data cell format. Computer file inputs include Landsat MSS data, mapped data such as environmental habitats and permit locations, and associated textual data, and the final database for coastal Lafourche Parish, Louisiana consists of nine original data maps and eight PGIS-derived maps. Comparisons of maps from over an eight-year period indicate that marsh deterioration is rapidly occurring in the study area. R.R.

A86-46080

A COMPARISON OF THEMATIC MAPPER SIMULATOR AND THEMATIC MAPPER DATA FOR URBAN ENVIRONMENTS

B. N. HAACK (Ball State University, Muncie, IN) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 302-311. refs

Thematic Mapper Simulator (TMS) data collected for the Los Angeles Basin in July, 1980 were digitally examined to assess their utility for urban and near-urban land-cover delimitations. Statistics for twenty-one training sites respresenting eight land-cover types were obtained and examined using transformed divergence calculations for intraclass variability and the best bands for classification. Thematic Mapper (TM) data collected in December, 1982 were examined using the same training sites and analysis techniques as for the TMS data. The intent of this comparison was to assess the validity of simulator data in determining TM sensor performance. In this study, the TMS and TM data provided very similar results on their ability to delimit urban and near-urban land-covers. Author

A86-46085* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE LANDSAT THEMATIC MAPPER WORLD DATA BASE

R. W. LUDWIG, P. M. MASUOKA (NASA, Goddard Space Flight Center, Greenbelt, MD), and L. STUART IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 362-370.

A World Data Base of potential thematic mapper (TM) scenes was developed to aid in acquisition planning. The World Data Base contains geopolitical, geographic and economic regions along with a format that enables users to find the satellite day, sun angle and cloud cover probability for any month of the year. Scenes that have been acquired by TM and have an average cloud cover of 30 percent of less from July 1982 when TM was launched until the Landsat system was taken over by NOAA in September 1984 are also in the World Data Base. Processed data are referenced in maps and data bases at EROS Data Center; however, a large number of acquistions have never been processed and therefore are not accessible. The World Data Base enables the rapid location of scenes and areas with the least effort making it invaluable in TM scheduling. Users of TM data can use the World Data Base to determine if scenes of interest have been acquired, the acquisition date, and if scenes have been processed to computer-compatible tape (CCT). These uses of the World Data Base make it a valuable tool in the acquisition and location of TM scenes. Author

A86-46093

A LANDSAT-GENERATED PREDICTIVE MODEL FOR PREHISTORIC ARCHAEOLOGICAL SITES - AN EXAMPLE FROM DELAWARE'S COASTAL PLAIN

T. J. EVELEIGH (Autometric, Inc., Falls Church, VA) and J. F. CUSTER (Delaware, University, Newark) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 450-459. Research supported by the University of Delaware Research Foundation, National Park Survey, Delaware Department of Transportation, and Arthur Volkman Memorial Fund. refs

The determination of site probability with a logistic regression model that uses an environmental database as the source of independent variables is examined. The development of the database for the model using Landsat imagery of the Delaware coastal plain, specifically the Saint Jones and Murderkill drainages, is described. The training of the model is considered. The application of the model to the prediction of the potential site distribution in the Delaware coastal plain is discussed. It is noted that the Landsat data is useful for mapping of large ecological and environmental zones. I.F.

A86-46100* Utah Univ., Salt Lake City.

A GEOGRAPHIC INFORMATION SYSTEM FOR RESOURCE MANAGERS BASED ON MULTI-LEVEL REMOTE SENSING DATA

D. J. WHEELER and M. K. RIDD (Utah, University, Salt Lake City) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 528-537. Research supported by the Utah Department of Agriculture. Previously announced in STAR as N85-15249.

(Contract NAGW-95)

Procedures followed in developing a test case geographic information system derived primarily from remotely sensed data for the North Cache Soil Conservation District (SCD) in northern Utah are outlined. The North Cache SCD faces serious problems regarding water allocation, flood and geologic hazards, urban encroachment into prime farmland, soil erosion, and wildlife habitat. Four fundamental data planes were initially entered into the geo-referenced data base: (1) land use/land cover information for the agricultural and built-up areas of the valley obtained from various forms of aerial photography; (2) vegetation/land cover in mountains classified digitally from Landsat; (3) geomorphic terrain units derived from aerial photography and soil maps; and (4) digital terrain maps obtained from DMA digital data. The land use/vegetation/land cover information from manual photographic and Landsat interpretation were joined digitally into a single data plane with an integrated legend, and segmented into quadrangle units. These were merged with the digitized geomorphic units and the digital terrain data using a Prime 400 minicomputer. All data planes were geo-referenced to a UTM coordinate grid. Author

A86-46108

TRANSPORTATION APPLICATIONS OF REMOTE SENSING INFORMATION

C. R. FERGUSON (Towne Engineering, Inc.; Connecticut, University, Mansfield) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 642-650. refs

General and engineering remote sensing applications are studied. The use of a land information system or multipurpose cadastres for transportation projects is examined. A land information system is designed to collect, store, manipulate, integrate, and analyze data pertaining to land parcels. Multipurpose cadastres are registers of land parcels containing data ranging from ownership and location to soil type and demographics. The development of property boundary coordinates with a combination of ground surveying and analytical photogrammetric techniques is described. GPS satellite surveying which involves estimating coordinates from recorded satellite signals is analyzed. The advantages these procedures will provide to the development of transportation systems are discussed. I.F.

A86-48952

REMOTE SENSING AND AN EXPERIMENTAL GEOGRAPHIC INFORMATION SYSTEM FOR ENVIRONMENTAL MONITORING, RESOURCE PLANNING AND MANAGEMENT

J. A. T. YOUNG (Edinburgh, University, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, June 1986, p. 741-744.

A86-48955

REMOTE SENSING IN LAND-USE PLANNING - AN APPLICATION IN WEST CENTRAL SCOTLAND USING SPOT-SIMULATION DATA

G. M. BUCHAN (Strathclyde Regional Council, Dept. of Physical Planning, Glasgow, Scotland) and N. K. HUBBARD (Environmental Remote Sensing Applications Centre, Ltd., Livingston, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, June 1986, p. 767-777. refs

A86-49606#

REMOTE SENSING AS AN AID IN 'SPATIAL PLANNING' [FERNERKUNDUNG ALS HILFSMITTEL IN DER RAEUMLICHEN PLANUNG]

F. ARNOLD (Bundesforschungsanstalt fuer Naturschutz und Landschaftsoekologie, West Germany) BMFT, Statusseminar ueber die Nutzung von Fernerkundungsdaten in der Bundesrepublic Deutschland, Garmisch-Partenkirchen, West Germany, Jan. 20-22, 1986, Paper. 8 p. In German.

Planning for which the 'spatial reference plane is the surface of the earth' is considered. The considered planning activities are concerned with the preservation of environment, ecology, and nature. In addition, problems related to a restoration of ecological performance characteristics for man have to be resolved. Such planning activities must be based on knowledge and data regarding the basic processes and phenomena involved. There exists, however, in West Germany an 'information deficit' regarding the information required. Approaches for overcoming this difficulty with the aid of remote sensing are discussed, taking into account also weaknesses regarding the data currently provided by aircraft-borne and satellite-borne equipment. These weaknesses are partly already being eliminated in connection with the development of high-resolution sensors for Landsat IV and the SPOT simulation program. Certain problems regarding the utilization of remote sensing data arise in connection with rising costs. G.R.

A86-49723* New York State Univ., Syracuse.

THE USE OF MULTIDATE MULTICHANNEL RADIANCE DATA IN URBAN FEATURE ANALYSIS

M. J. DUGGIN (New York, State University, Syracuse), R. ROWNTREE (USFS, Northeastern Forest Experiment Station, Syracuse, NY), M. EMMONS (NASA, Goddard Space Flight Center, Greenbelt, MD), N. HUBBARD (ERSAC, Ltd., Livingston, Scotland), A. W. ODELL (Royal Aircraft Establishment, Space Dept., Farnborough, England) et al. Remote Sensing of Environment (ISSN 0034-4257), vol. 20, Aug. 1986, p. 95-105. USFS-supported research. refs

(Contract NAS5-27595)

Two images were obtained from thematic mappers on Landsats 4 and 5 over the Washington, DC area during November 1982 and March 1984. Selected training areas containing different types of urban land use were examined,one area consisting entirely of forest. Mean digital radiance values for each bandpass in each image were examined, and variances, standard deviations, and covariances between bandpasses were calculated. It has been found that two bandpasses caused forested areas to stand out from other land use types, especially for the November 1982 image. In order to evaluate quantitatively the possible utility of the principal components analysis in selected feature extraction, the eigenvectors were evaluated for principal axes rotations which rendered each selected land use type most separable from all other land use types. The evaluated eigenvectors were plotted as a function of land use type, whose order was decided by considering anticipated shadow component and by examining the relative loadings indicative of vegetation for each of the principal components for the different features considered. The analysis was performed for each seven-band image separately and for the two combined images. It was found that by combining the two images, more dramatic land use type separation could be obtained. Author

A86-49766

USE OF SPACE IMAGERY IN STUDIES OF THE EVOLUTION OF PRESENT-DAY LANDSCAPES [PRIMENENIE KOSMICHESKIKH SNIMKOV PRI IZUCHENII RAZVITIIA SOVREMENNYKH LANDSHAFTOV]

E. V. GLUSHKO, IU. G. ERMAKOV, and A. A. SEREBROV (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1986, p. 21-28. In Russian. refs

The application of periodically obtained space imagery (SI) of large geographic areas to the analysis of landscape evolution processes is discussed. Evolution processes, classified into rhythmic changes in the course of land cover development, dynamic cover changes caused by irreversible transformations of land cover, and evolutionary changes due to replacement of one land cover by another, which are described. As an example, the dynamics of land cover in the Central Hamib Desert is analyzed using SI obtained by Gemini-5 in 1965, Salyut-6 in 1978, and Salyut-7 in 1982. I.S.

A86-50231

CORSICA - REMOTE SENSING, CARTOGRAPHY AND MONITORING OF THE ENVIRONMENT [CORSE - TELEDETECTION SURVEILLANCE DE CARTOGRAPHIE ET L'ENVIRONNEMENT]

P.-Y. REVILLION (Bureau pour le Developpement de la Production Agricole, France) Metropolis (ISSN 0224-1250), no. 70-71, 4th Quarter, 1985, p. 20-26. In French.

The uses to which airborne photography and Landsat remote sensing imagery have been put as a prelude to utilizing SPOT imagery for land use planning in Corsica are described. The planning goals are to achieve a balance among the needs of agriculture, urbanization, natural ecologies, and tourism. Airborne studies aided in identifying the required cartographic scales to be 1:100,000 and 1:25,000 for alerts and for monitoring sensitive areas, respectively. Satellite imagery is necessary to obtain relatively frequent multitemporal data on areas which are known or projected to undergo rapid changes due to, e.g., urbanization or forest fires. Landsat imagery has proven detailed enough to distinguish tree types for plots of 1-5 ha, using false color techniques when available contrast is high. The effectiveness of SPOT images was evaluated using an airborne radiometer to simulate the 10 m resolution SPOT images. The simulated SPOT images show promise for monitoring the appearance of even small copses of trees and individual buildings. M.S.K.

A86-50232

THE FIRST APPLICATION OF THE THEMATIC MAPPER OVER ILE-DE-FRANCE - THE ENVIRONMENT [PREMIERE APPLICATION DU THEMATIC MAPPER EN ILE-DE-FRANCE L'ENVIRONNEMENT]

R. DELAVIGNE and C. THIBAULT (Ile-de-France, Institut d'Amenagement et d'Urbanisme, Paris) Metropolis (ISSN 0224-1250), no. 70-71, 4th Quarter, 1985, p. 29-34. In French.

Sample imagery and interpretive results are presented from Landsat Thematic Mapper scans of various parcels in the Ile-de-France region. False color images are provided of forested, suburban, agricultural and urban areas. The classification techniques and different bands selected to discern, e.g., trees from soil types from buildings, among various crops, among densities of buildings, and the extent of vegetal ground cover, are described. Measurements were also made of the total biomass in the regions scanned, which consisted of eight areas bordering each other. Although the images illustrate the range of data available with the second generation sensors on-board Landsat and SPOT, it is noted that significant efforts must continue in developing interpretive techniques if the wealth of information now accessible is to be exploited fully. M.S.K.

A86-50233
SIMULATIONS OF SPOT IMAGERY OF PARIS - CHANGES IN THE URBAN FABRIC [SIMULATIONS SPOT A PARIS - MUTATIONS DU TISSU URBAIN]
A. BALLUT and P. T. NGUYEN Metropolis (ISSN 0224-1250), no. 70-71, 4th Quarter, 1985, p. 35-39. In French.

Urban planning is concerned with guiding the growth of cities in a manner which preserves farmland and natural settings, ensures the quality of urban life, and satisfies economic demands. One of the needs of imagery of urban areas is to track the growth of the various types of buildings, e.g., offices, apartments, etc. This can be accomplished with airborne photography at any date of choice, but the information return is slow and expensive to keep repeating for multitemporal tracking. Remote sensing data from Landsat 4 with a Thematic Mapper have yielded urban images with 30 m x 30 m resolution. SPOT images are to be 20 m x 20 m and 10 m x 10 m for the multispectral and monochromatic bands, respectively. The monochromatic band will provide data on buildings from block to block and permit detailed statistical analyses of the total distribution of land use in cities. The results of a classification simulation for SPOT imagery are presented to demonstrate the capability of obtaining imagery of Paris laid out in a grid with a minimal scale of 1250 sq m. M.S.K.

A86-50234
MULTITEMPORAL IMAGERY OF ATHENS [UNE IMAGE DIACHRONIQUE D'ATHENES]
S. RIMBERT (CNRS, Laboratoire de Cartographie Thematique; Strasbourg I, Universite, France) Metropolis (ISSN 0224-1250), no. 70-71, 4th Quarter, 1985, p. 40-44. In French.
(Contract CNES-83-208)

Rapid urban expansion is attended by the shrinkage of surrounding natural or farmed countryside and accompanied by aggressive construction projects. The population of Athens has grown from less than 2 million in 1961 to over 3 million in 1981. However, the most recent topographical map of the area was completed in 1961. Landsat bands 4-7 were employed to generate a new topographical map for a display consisting of 105,000 points. Four multispectral images were acquired in June 1975 and July 1981. The data were analyzed by a method of principal components, which permitted identifying changes that took place in the interval between the two scans. The analysis criteria included developed, bare or green (vegetated) areas, radiometric brightness, and differences between the image pixels on different dates. Sample imagery overlaid on old topographical maps are discussed in historical terms covering two centuries to illustrate the changes that have occurred in Athens in fairly minute detail. M.S.K.

N86-31044# Rochester Univ., N. Y. Lab. for Laser Energetics.
LABORATORY FOR LASER ENERGETICS Annual Report, 10 Oct. 1984 - 30 Sep. 1985
Jan. 1986 232 p
(Contract DE-FC08-85DP-40200)
(DE86-006834; DOE/DP-40200/05) Avail: NTIS HC A11/MF A01

Overviews of the GDL and OMEGA facilities are given. The retrofit of the GDL with liquid crystal polarizers is described. Synchronization of the actively mode-locked and actively Q-switched oscillators is described. Progress in laser fusion includes a theory of electron heat transport, sputter-coating of laser targets, absorption line measurement of the tamper, x-ray conversion for high-Z targets, mass ablation in uv-irradiated targets, uv target designs, stimulated Raman scattering in a collisional homogeneous plasma, and absorption spectroscopy as a diagnostic. DOE

N86-31950# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A PROPOSAL FOR THE DEVELOPMENT OF A LARGE-SCALE TOPOGRAPHIC-CARTOGRAPHIC DATA BASE TAKING THE PLANIMETRIC DATA OF AUTOMATED CADASTRAL MAP (ALK) SYSTEM INTO ACCOUNT [EIN VORSCHLAG ZUM AUFBAU EINER GROSSMASSTAEBIGEN TOPOGRAPHISCH-KARTOGRAPHISCHEN DATENBANK UNTER BESONDERER BERUECKSICHTIGUNG DER GRUNDRISSDATEI DES ALK-SYSTEMS]
D. GRUENREICH *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 p 55-70 1985 In GERMAN; ENGLISH summary
Avail: NTIS HC A09/MF A01

The database system developed in computer-assisted production, revision and use of cadastral maps in digital form is used to establish a large-scale topographic-cartographic data base (1:5,000). Cadastral maps with 70% of the planimetric information of topographic maps are one of the most important sources for the conventional production and revision of the German Basic Map 1:5,000 (DGK 5). A digital data interconnection system between digital cadastral maps (ALK) and the Digital Landscape Model 1:5,000 (DLM 5) is proposed. A graph theory-based procedure for automatic generalization of digital cadastral maps is described. Topographic information which can not be derived from cadastral maps is to be gained using digital photogrammetric procedures and linked to the ALK data. Applications in geosciences, spatial planning, and cartographic generalization for small-scale DLM are shown. ESA

N86-32515# IFC Research, Claygate (England).
STUDY OF INFORMATION DISSEMINATION BY SATELLITE, RIDER 2: CULTURAL SATELLITE CONSORTIUM: WIDENING THE SCOPE Final Report
B. G. CHAMPNESS Paris ESA Aug. 1985 54 p
(Contract ESA-5820/84-NL-DG)
(ESA-CR(P)-2171-VOL-2; ETN-86-97489-VOL-2) Avail: NTIS HC A04/MF A01

The need for a European Cultural Satellite Consortium to manage the participation of educational and cultural organizations in ESA's Olympus satellite program was established. The feasibility of widening its scope, by bringing in medical, health and other public service bodies was examined. Guidelines for its planning and development, drawing on the experience of the Public Service Satellite Consortium, Washington, were drawn up. Ways of strengthening its economic and entrepreneurial base were considered. A set of objectives, a list of major functions, a suggested structure, and suggestions for its management are given. ESA

N86-32854# North East London Polytechnic, Dagenham (England). Dept. of Land Surveying.
OPTICAL AND INFRARED MULTISPECTRAL IMAGERY LAND USE APPLICATIONS 2
R. K. BULLARD *In* ESA Remote Sensing Applications in Civil Engineering p 123-127 Mar. 1985
Avail: NTIS HC A06/MF A01

Applications of visible and infrared remote sensors for land use studies are discussed. Methods of obtaining imagery, need for ground data, establishing the classification, sampling, and reliability are considered. Agricultural land use and its encroachment by urban development are commented upon as are the need to monitor changes including those brought about by civil engineering projects. Derelict land and pollution monitoring by remote sensing are mentioned. ESA

N86-32855# Transport and Road Research Lab., Crowthorne (England). Overseas Unit.
REMOTE SENSING FOR HIGHWAY ENGINEERS
P. J. BEAVEN *In* ESA Remote Sensing Applications in Civil Engineering p 129-137 Mar. 1985
Avail: NTIS HC A06/MF A01

It is shown how highway engineers can interpret remotely sensed imagery for all scales of survey. At reconnaissance scale satellite photographic products are appropriate; for more detailed studies image processors must be used, but for the greatest detail, stereoscopic aerial photographs are essential. Advice on the choice of the appropriate imagery for different surveys and on how the interpretation should be organized is given. The emphasis for highway engineering is on visual interpretation, and it is shown that there are economical ways of obtaining a high quality image using low cost equipment. ESA

N86-32860# National Remote Sensing Agency, Hyderabad (India).
APPLICATION POTENTIAL OF REMOTE SENSING: A CASE FOR NATURAL RESOURCES MANAGEMENT SYSTEM
I. V. MURALIKRISHNA *In* ESA Remote Sensing Applications in Civil Engineering p 169-174 Mar. 1985
Avail: NTIS HC A06/MF A01

The Indian Remote Sensing satellite (IRS-1) program is outlined. A long program of IRS utilization is expected to provide a basic input to technology operationalization. The natural resources management system conceived under IRS utilization is expected to create demand for remotely sensed data and promote acceptance of the technology as a basic tool for resource monitoring and management. The information system required, and application to coastal erosion and environmental monitoring are discussed. ESA

03

GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A86-43261* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TOPEX ORBIT DETERMINATION BY SOLVING GRAVITY PARAMETERS WITH MULTIPLE ARC DATA
J.-T. WU (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Astrodynamics 1985; Proceedings of the Conference, Vail, CO, August 12-15, 1985. Part 2 . San Diego, CA, Univelt, Inc., 1986, p. 1119-1141. NASA-supported research. refs
(AAS PAPER 85-411)

Multiple arc data from repeated ground track are combined to reduce the error due to gravity field uncertainty in the determination of TOPEX orbit. The TOPEX dynamics is modeled with relatively few gravity parameters to account for the effect of the local gravity field. The gravity parameters are common to all arcs. The estimation algorithm uses the Householder transformation to combine multiple arc data and solve for the gravity parameters. The earth gravity field can be recovered with very modest amount of calculation. Author

A86-43961
THE EVOLVING ALASKA MAPPING PROGRAM
P. D. BROOKS (USGS, National Mapping Div., Anchorage, AK) and T. J. OBRIEN (USGS, National Mapping Div., Denver, CO) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, June 1986, p. 769-777.

Early developments related to mapping activities in Alaska are examined. An important milestone in the photogrammetric production of Alaska maps was reached when the Geological Survey mapped the Brooks Range in 1956-57. A program concerned with the provision of maps at a scale of 1:63,360 was begun in 1948 to serve both civil and military requirements. The current status of topographic mapping in Alaska is discussed, taking into account the Alaska High-Altitude Aerial Photography Program, 1:25,000-scale topographic maps, 1:63,360-scale topographic maps, a statewide orthophotoquad program, 1:250,000-scale topographic maps, and topographic/bathymetric products. Special products described are related to Landsat image mapping, the Federal Lands Subject to Mineral Restrictions Map, Alaska National Interest Lands Conservation Act maps, and side-looking airborne radar map products. Attention is also given to vegetation and land-cover mapping, small-scale map products, digital data, and information and data services. G.R.

A86-45161
THERMAL STRESSES IN THE OCEANIC LITHOSPHERE - EVIDENCE FROM GEOID ANOMALIES AT FRACTURE ZONES
E. M. PARMENTIER (Brown University, Providence, RI) and W. F. HAXBY (Lamont-Doherty Geological Observatory, Palisades, NY) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, June 10, 1986, p. 7193-7204. refs
(Contract NSF OCE-85-11011)

To demonstrate that thermal stresses may cause significant geoid anomalies, a theoretical formulation, more general than previous formulations, is outlined for thermal stresses in thin plates. A simple, idealized model is developed for flexure of the lithosphere at fracture zones (FZs) due to thermal stresses, and the resulting geoid anomaly is estimated. The predicted amplitude of the anomaly is large enough to be observed in Seasat altimeter profiles. Geoid profiles across FZs, derived from satellite altimetry, are shown in which the predicted anomaly can be easily recognized. This supports the existence of thermal stresses with a magnitude and depth distribution like that predicted by the model. D.H.

A86-46053
DATA SNOOPING USING OBSERVATIONS AND PARAMETERS WITH CONSTRAINTS
K. JEYAPALAN (Iowa State University of Science and Technology, Ames) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 22-28.

Least squares methods are widely used in photogrammetric and geodetic computations. One problem in the least squares method is assigning a priori weights to different observations and parameters. Another is the detection of noises that are the size of the random errors. The author, using the probability and the conditional probability of the residuals to compute the weigth of the residual, has developed a method of detecting noises and compensating for them in a recursive adjustment procedure. This method was successfully used in the detection of monument movement in an Electronic Distance Measurement Instrument (EDMI) calibration. The method has photogrammetric and geodetic applications. Author

A86-46271
COORDINATE DETERMINATION BY A MULTIPLE-ARM RADIOINTERFEROMETER USING NAVIGATION-GEODESIC SATELLITES [OPREDELENIE KOORDINAT MNOGOPLECHEVYM RADIOINTERFEROMETROM PO NAVIGATSIONNO-GEODEZICHESKIM SPUTNIKAM]
N. A. AZBUKINA, V. A. VASILEV, V. M. ZINENKO, and V. G. PESHEKHONOV Kosmicheskie Issledovaniia (ISSN 0023-4206), vol. 24, May-June 1986, p. 466-468. In Russian.

Reference is made to an earlier study (MacDoran, 1979) in which a method has been proposed for determining the coordinates of ground point by using a multiple-arm radiointerferometer observing four satellites. The method relies on step-by-step survey control, with the maximum distance between a new point and the reference points not exceeding 200 km. It is shown here that the requirement of step-by-step control can be avoided by using 5-6 reference point instead of four. Five reference points should be spaced apart by about 30 deg (3000 km), while the 6th point can be located 2-3 times closer. The mean value of the geometrical factor is 5-10; the accuracy of the new method is several decimeters less than that of the MacDoran method. V.L.

A86-46808
SEASAT-DERIVED GRAVITY OVER THE MUSICIANS SEAMOUNTS
A. P. FREEDMAN and B. PARSONS (MIT, Cambridge, MA) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, July 10, 1986, p. 8325-8340. refs
(Contract N00014-80-C-0273)

Two-dimensional maps of gravity derived from Seasat data for the Musicians seamount province north of Hawaii are compared with gravity predicted from bathymetry of that area using a theoretical admittance. A minimum-curvature interpolation scheme is determined to be the more accurate and cost effective mapping method than other methods that were tried, while gravity obtained by Fourier transforming the geoid produces more reliable gravity maps. The Seasat-derived gravity tends to favor a thin plate with an effective elastic thickness of about 5 km, though the east-west ridges in the south display a smaller signal more consistent with Airy compensation. This variation may be indicative of early fracturing of the lithosphere in the south, or it may be a manifestation of the age difference and early thermal structure across the Murray fracture zone, which separates the seamount province into northern and southern sections. C.D.

N86-28563# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
THE ESTIMATION OF GEOPOTENTIALS BY WAY OF GEOPHYSICAL INVERSE THEORY
M. T. LANE and E. M. GAPOSCHKIN 27 Jan. 1986 33 p
(Contract F19628-85-C-0002)
(AD-A165691; TR-735; ESD-TR-85-279) Avail: NTIS HC A03/MF A01 CSCL 08E

Satellite to satellite tracking data (SST) can be used to measure the geopotential at the satellite altitude. This measurement can be used to estimate the Earth's gravity field at the Earth's surface, the so-called inverse problem. Geophysical inverse theory is applied to this inverse problem, and numerical methods are developed and tested. Geophysical inverse theory is used to map the geopotential from the satellite altitude to a lower surface. Two configurations are explored and the geopotential in a local network is recovered with less than 4% error. GRA

N86-29440# Federal Geodetic Control Committee, Washington, D.C.
INPUT FORMATS AND SPECIFICATIONS OF THE NATIONAL GEODETIC SURVEY DATA BASE. VOLUME 3: GRAVITY CONTROL DATA (REVISED SEPTEMBER 1985)
W. T. DEWHURST Sep. 1985 166 p
(PB86-187010) Avail: NTIS HC A08/MF A01 CSCL 08E

The user's guide to the formats and specifications used within the National Geodetic Survey (NGS) data base is commonly referred to as the Blue Book, and is comprised of three volumes. Gravity control (GRAV) data are discussed. GRA

N86-31095# Defense Mapping Agency Hydrographic and Topographic Center, Washington, D.C.
A COMPARISON OF ADOS (AFRICAN DOPPLER SURVEY) POINT POSITIONING RESULTS FROM VARIOUS SOFTWARES Final Report
T. J. KNOPP 27 Feb. 1986 16 p Presented at the International Geodetic Symposium on Satellite Positioning, Austin, Tex., 28 Apr. - 2 May 1986
(AD-A166840; AD-E950814) Avail: NTIS HC A02/MF A01 CSCL 08E

The African Doppler Survey project (ADOS) is a multi-national effort to establish primary control (via Doppler satellite observations) on the African continent. There are four Computing Centers under the ADOS project which use three different point positioning programs. These programs are: DOPL79, GEODOP V, and ORB-SPP. The differences observed in the computations using the various softwares were recently investigated. This paper presents preliminary results of this study. GRA

N86-31557# Bonn Univ. (West Germany). Geodaetisches Inst.
DEVELOPMENT OF A RECEIVER CONCEPT FOR GEODETIC APPLICATION OF THE NAVSTAR GLOBAL POSITIONING SYSTEM (GPS) SATELLITE NAVIGATION SYSTEM Final Report, Feb. 1985
E. SAUR Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 25 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-85-036; ISSN-0170-1339; ETN-86-97474) Avail: NTIS HC A02/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 5.50

The instrument measurement errors in a GPS receiver (a coherent C/A code cross-correlation receiver with carrier phase measurements and higher process gain, capable of using the P code modulated L2 frequency) are studied. The GPS receiver consists of a ZF amplifier, a mixing frequency preparation unit, and a digital signal processing unit including a code generator, a correlator, a numerical oscillator, and control and evaluation computers. The geodetic GPS receiver is analyzed as regards mobility, human factors engineering, interference, possible connections, and independence from external data sources. The cost effective multiplex scheme is selected for simultaneous measurements of four satellites leading to signal delay reduction. A subminiature rubidium standard is used as a receiver black to avoid loss of accuracy at higher integration times. ESA

N86-31946# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
REPORTS ON CARTOGRAPHY AND GEODESY. SERIES 1: ORIGINAL REPORTS, NUMBER 95 [NACHRICHTEN AUS DEM KARTEN- UND VERMESSUNGSWESEN. REIHE 1: HEFT NR. 95]
1985 200 p In GERMAN; ENGLISH summary Original contains color illustrations Document contains maps as supplement
(ISSN-0469-4236; ETN-86-97479) Avail: NTIS HC A09/MF A01

Research on automated cartography (data acquisition, processing and retrieval) with economical use and feasibility analyses is reported. Development of data bases, user interfaces and interactive graphical systems is described. Image processing and resolution are improved. ESA

N86-32786 Centre National d'Etudes Spatiales, Toulouse (France).
INTERNATIONAL GEOPHYSICS AND SPACE
1985 615 p Partly in ENGLISH and FRENCH Lectures presented at CNES Summer School, Toulouse, France, 2-27 Jul. 1984
(ISBN-2-85428-132-2; ISSN-0766-1002; ETN-86-97644) Avail: CEPADUES, Toulouse, France

Space techniques used in solid Earth studies were discussed. Shape, gravity and magnetic fields, and surface and internal deformation were considered. ESA

N86-32787 Institut de Physique du Globe, Paris (France).
THE GEOMAGNETIC FIELD: DESCRIPTION AND ANALYSIS [LE CHAMP GEOMAGNETIQUE: DESCRIPTION ET ANALYSE]
J. L. LEMOUEL *In* CNES International Geophysics and Space p 17-60 1985 In FRENCH
Avail: CEPADUES, Toulouse, France

Measurements and models of the Earth's magnetic field using spaceborne and ground based techniques are introduced. Crustal anomalies are discussed. Large wavelength anomalies are illustrated. The Magsat satellite system is presented. ESA

N86-32789 Institut de Physique du Globe, Paris (France).
ENERGY SOURCES AND THE THERMAL HISTORY OF THE EARTH [SOURCES D'ENERGIE ET HISTOIRE THERMIQUE DE LA TERRE]
C. JAUPART *In* CNES International Geophysics and Space p 85-109 1985 In FRENCH
Avail: CEPADUES, Toulouse, France

The heat flux of the Earth is introduced and conductive flow and flow through the ocean crust are discussed. Measurement methods, including bathymetry, are explained, and heat transfer traced. The radioactivity of rocks is considered and the concentrations of radioactivity in the mantles are summarized. The thermal balance of the Earth and the thermal evolution of the planet are considered. ESA

N86-32790 Massachusetts Inst. of Tech., Cambridge.
MANTLE CONVECTION AND THE EARTH'S GRAVITY FIELD
B. PARSONS *In* CNES International Geophysics and Space p 111-158 1985
Avail: CEPADUES, Toulouse, France

Observational constraints in geophysics are discussed, and depth extent of convection, and small-scale convection are considered. Laboratory and numerical experiments (planform of convection; stability considerations; aspect ratios; influence of shear flows) are described. The variation of geoid height and ocean floor bathymetry with age (thermal models; isostatic compensation; the depth-age and geoid-age relationships) are introduced. Geoid and depth anomalies and convection (integral expressions; dynamic compensation; effective temperatures; relationship between depth and geoid anomalies) are treated. Small-scale convection (satellite altimetry and bathymetry; instabilities beneath cooling oceanic lithosphere; midocean swells; connection with depth-age and geoid-age relationships) is summarized. ESA

N86-32791 Centre National d'Etudes Spatiales, Toulouse (France).
SATELLITE TRACKING: ITS FIRST CONTRIBUTIONS TO THE KNOWLEDGE OF THE EARTH'S GRAVITATIONAL FIELD AND TO GEOPHYSICS [LA POURSUITE DES SATELLITES; SES PREMIERS APPORTS A LA CONNAISSANCE DU CHAMP GRAVIMETRIQUE TERRESTRE ET A LA GEOPHYSIQUE]
B. LAGO *In its* International Geophysics and Space p 159-199 1985 In FRENCH
Avail: CEPADUES, Toulouse, France

The contribution of techniques developed for tracking satellites to detect discrepancies in the Earth's hydrostatic balance is recalled. Static and dynamic explanations for the imbalance are considered. The flattenning of the geoid detected by satellite geodesy is discussed. Global models of Earth gravitation are introduced. Laboratory experiments; convection equations; and convection in the Earth's mantle are described. ESA

N86-32800 Bureau Gravimetrique International, Toulouse (France).
POTENTIAL MODELS [MODELES DE POTENTIEL]
G. BALMINO *In* CNES International Geophysics and Space p 499-526 1985 In FRENCH
Avail: CEPADUES, Toulouse, France

Global models of the Earth's gravitational field based on spherical harmonics, such as GEM, GRIM, SAO, and NWL, are introduced. Analysis of orbit perturbation and surface data is outlined. The data used and their processing are discussed. It is concluded that knowledge of geopotential is insufficient for accurate satellite trajectory determination, for ocean geoid determination, and for regional geophysical investigations where gravity is only known through trajectory analysis. The situation can be improved by using very low orbit, drag free satellites; by improving satellite altimetry; and by using onboard gravity gradiometers. ESA

N86-32804 Centre National d'Etudes Spatiales, Toulouse (France). Groupe de Recherche de Geodesie Spatiale.
UTILIZATION OF SPACE TECHNIQUES FOR ACCURATE POSITIONING IN GEOPHYSICS [UTILISATION DES TECHNIQUES SPATIALES DE POSITIONNEMENT PRECIS EN GEOPHYSIQUE]
M. LEFEBVRE *In its* International Geophysics and Space p 599-614 1985 In FRENCH
Avail: CEPADUES, Toulouse, France

Radio, laser, Doppler, and interferometric space-based positioning techniques are reviewed. Links between measurement errors and errors in significant physical parameters are discussed. Choice criteria for a system for geophysics are given. ESA

N86-32912*# Texas Univ., Austin. Center for Space Research.
ALTIMETER MEASUREMENTS FOR THE DETERMINATION OF THE EARTH'S GRAVITY FIELD Semiannual Research Progress/Status Report, 18 Mar. - 14 Sep. 1986
B. D. TAPLEY, B. E. SCHUTZ, and C. K. SHUM 25 Sep. 1986 9 p
(Contract NAG5-746)
(NASA-CR-176893; NAS 1.26:176893) Avail: NTIS HC A02/MF A01 CSCL 08N

Progress in the following areas is described: refining altimeter and altimeter crossover measurement models for precise orbit determination and for the solution of the earth's gravity field; performing experiments using altimeter data for the improvement of precise satellite ephemerides; and analyzing an optimal relative data weighting algorithm to combine various data types in the solution of the gravity field. B.G.

04

GEOLOGY AND MINERAL RESOURCES

Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology.

A86-44169
GEOLOGICAL ASSESSMENT OF SIR-B IMAGERY OF THE AMADEUS BASIN, N.T., AUSTRALIA
G. J. LYNNE and G. R. TAYLOR (New South Wales, University, Kensington, Australia) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 575-581. Research supported by the Esso Australia Ltd. refs

When SIR-B imagery of the arid margin of the Simpson Desert of Central Australia is combined with Landsat MSS principal component data, regional geological structures are clearly defined. A variety of sedimentary lithological units are mapped on the basis of outcrop morphology and MSS spectral variations on the color-composite image. Relative backscatter power from SIR-B digital imagery is observed to correlate with surface roughness for a variety of lithological terrains. Author

A86-44170* Cornell Univ., Ithaca, N.Y.
SIR-B RADAR IMAGERY OF VOLCANIC DEPOSITS IN THE ANDES
E. J. FIELDING, W. J. KNOX, JR., and A. L. BLOOM (Cornell University, Ithaca, NY) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 582-589. refs
(Contract JPL-956926; NGT-33-010-801)

Synthetic-aperture radar imagery from the Shuttle Imaging Radar - mission B (SIR-B) was collected in October 1984 over the central Andes between 20 deg S and 24 deg S and also south of 42 deg S. Despite signal-strength problems that drastically reduced the signal-to-noise ratio of the images, volcanic features of both areas show up well. In particular, ignimbrite sheets formed by large explosive eruptions stand out as very strong radar reflectors. High backscatter is apparently caused by erosional relief on the ignimbrites at scales ranging from the radar wavelength (23 cm for SIR-B) to the 30-200-m scale of quebradas (gullies and canyons). The consistent regional erosional pattern appears unrelated to the emplacement of the ignimbrites, and is probably caused by preferential eolian erosion in the directions of the prevailing wind. Hand-held space photographs, ground observations, and Landsat Thematic Mapper imagery support the interpretation of the ignimbrite radar signature. The Chilean volcano Michinmahuida was imaged by four radar data takes at different incidence angles, which show tectonic, glacial, and volcanic features of that nearly inaccessible and often cloud-covered region. Stereo viewing of radar images from two data takes greatly enhances the geologic interpretation of this rugged area. Author

A86-46061

CORRELATION OF REMOTELY DETECTED MINERALOGY WITH HYDROCARBON PRODUCTION, LISBON VALLEY, UTAH

D. B. SEGAL, M. DEC. RUTH, I. S. MERIN (Earth Satellite Corp., Chevy Chase, MD), H. WATANABE, K. SODA (JAPEX Geoscience Institute, Inc., Tokyo, Japan) et al. IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 115-127. refs

An examination of remotely sensed data and geochemistry correlates specific diagenetic mineral assemblages within the Wingate Formation with hydrocarbon production at Lisbon Valley, Utah. Bleached Wingate exposures were identified using broadband Landsat Multispectral Scanner and airborn Thematic Mapper Simulator data as a result of ferric-iron content and the relative abundance of clay minerals. High-resolution airborn spectroradiometric data, thin sections, and X-ray diffraction indicate that bleached rocks overlying the reservoir at Lisbon Valley contain abundant kaolinite and small amounts of feldspar, while unbleached exposures contain less clay and abundant feldspar. The correlation found between the abundance of clays and apparent hydrocarbon microseepage suggests that the effects of hydrocarbon microseepage may be mapped with broadband sensors. R.R.

A86-46095

UTILIZATION OF LANDSAT DATA IN THE DETECTION OF LINEAMENTS IN THE SOUTH CENTRAL ALBORZ MOUNTAINS OF NORTHERN IRAN

S. BAGHERI (New Jersey Institute of Technology, Newark) and R. W. KIEFER (Wisconsin, University, Madison) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 481-491. refs

This study involves the evaluation of remote sensing technology using Landsat data for the detection of lineaments in the south-central Alborz Mountains of northern Iran. Both visual and computer-enhanced interpretation techniques were employed in this study. One application of remote sensing is to acquire facts about a terrain that can aid in deciphering the underlying geologic structure and ultimately, its tectonic evolution. In depicting terrain, the particular value of remote sensing using Landsat data lies in the small scale synoptic view and uniform aerial coverage provided. The major contribution of Landsat imagery in mineral exploration and seismic activities has been the identification of previously unknown lineaments (faults and fracture systems). Concentrations of lineaments may indicate where the crust is weakest and, therefore, most likely to be mineralized or susceptible to seismic activity. In this study, a correlation was found between lineaments detected in the study area, the zone of weakness characterized by seismic activity, and mineral concentrations (phosphate deposits). Author

A86-46118

DATA ACQUISITION AND APPLICATIONS OF SIDE-LOOKING AIRBORNE RADAR IN THE U.S. GEOLOGICAL SURVEY

J. E. JONES and A. N. KOVER (USGS, National Mapping Div., Reston, VA) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 767-770.

A86-47803*

INTERNATIONAL SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT, FOURTH THEMATIC CONFERENCE: REMOTE SENSING FOR EXPLORATION GEOLOGY, SAN FRANCISCO, CA, APRIL 1-4, 1985, PROCEEDINGS. VOLUMES 1 & 2

Symposium organized by the Environmental Research Institute of Michigan; sponsored by ARCO Oil and Gas Co., NASA, and NOAA. Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. Vol. 1, 439 p.; vol. 2, 395 p. For individual items see A86-47804 to A86-47853.

State of the art applications of remote sensing in geological exploration programs are discussed along with research and development activities aimed at increasing the future capabilities of this technology for exploration geology. The topics considered include: technical issues in the state of the art; regional exploration models; remote sensing applications for hydrocarbon exploration; commercialization of remote sensing satellites; and data integration. Also addressed are: remote sensing applications for mineral exploration; geobotanical and environmental remote sensing; image processing techniques and applications; advanced sensors, radar, and airborne systems; and engineering, logistics, and marine applications. C.D.

A86-47804#

COMPARISON OF MAJOR LINEAMENT TRENDS TO SEDIMENTARY ROCK THICKNESSES AND FACIES DISTRIBUTION, POWDER RIVER BASIN, WYOMING

R. W. MARRS (Wyoming, University, Laramie) and R. S. MARTINSEN IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 9-19. refs

Landsat images in the Powder River Basin, Wyoming, have revealed the presence of a prominent set of major northeast-trending lineaments and a smaller set of major northwest-trending lineaments. It was found that patterns of deformation and sedimentation throughout the Paleozoic and Mesozoic eras parallel and often closely underlie the trends of these lineaments. The correlations support the concept that these lineaments are the result of periodic readjustments along the basement block boundaries. At least two previously recognized paleostructural uplifts, the Pathfinder Uplift and the Belle Fouche Arch, are bounded by lineaments, suggesting some periods of significant differential movement between crustal blocks. These findings indicate that lineament mapping can be an important tool for understanding and mapping subsurface facies distribution, especially in areas of sparse well control. I.S.

A86-47805#

THE MID-CONTINENT RIFT FRONTIER HYDROCARBON PLAY - A CASE STUDY BASED UPON AN ECONOMICAL APPROACH TO PROSPECT GENERATION

J. D. HERMAN, P. J. ETZLER, M. L. WILSON, and R. K. VINCENT (Geospectra Corp., Ann Arbor, MI) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 21-30. refs

A86-47806#

THE GABON BASIN - ITS REGIONAL SETTING WITH RESPECT TO ONSHORE BASEMENT TECTONIC ELEMENTS AS INTERPRETED FROM SIDE-LOOKING AIRBORNE RADAR IMAGERY

R. R. HERNER (MARS Associates, Inc., Phoenix, AZ) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 31-47. refs

A86-47807#

THE APPLICATION OF SHUTTLE IMAGING RADAR (SIR-B) TO TECTONIC ANALYSIS OF THE CANDELARIA REGION, NEVADA

M. X. BORENGASSER and J. V. TARANIK (Nevada, University, Reno) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 105-111.

The applicability of Shuttle Imaging Radar-B data to structural geology studies was investigated by interpreting the digital data collected over the Candelaria region of western Nevada in October 1984. Some of the tracks, acquired at incidence angles ranging from 59 to 18 deg, crossed one another at nearly right angles in this tectonically anomalous region, from which the Teels Marsh and Rhodes Salt Marsh subscenes were selected. The images in these subscenes were enhanced with Gaussian redistributions, edge enhancements, and false color composites, with the first two methods shown to be most effective in enhancing and displaying linear features. When compared with mapped faults and the results of field examination, most of the linears detected appeared to be unrelated to faulting, although mapped faults in an alluvial fan of the Pilot Mountains, which bound the Rhodes Salt Marsh on the east, coincided with linears produced by subtle, contrasting brightness. Field examination revealed that fault uplift had permitted erosional processes to remove finer clasts and produce small drainages. I.S.

A86-47808*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SPACE SHUTTLE RADAR INVESTIGATIONS OF INDONESIA

J. P. FORD (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) and F. F. SABINS, JR. (Chevron Oil Field Research Co., La Habra, CA) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 113-122. NASA-supported research.

A preliminary interpretation of structure and lithology from selected Shuttle Imaging Radar-B (SIR-B) images of Borneo, collected in October 1984, is presented. The SIR-B images, obtained at depression angles that ranged from 40 to 50 deg, were interpreted by using the approaches suggested by Sabins (1983). On the basis of radar signatures, six terrain categories; coastal and alluvial plains, and carbonate, clastic, volcanic, and melange, rocks, were defined in east, central, and south Kalimantan, and in the Malaysian state of Sarawak. I.S.

A86-47809*# Dartmouth Coll., Hanover, N.H.

DISCRIMINATION OF LITHOLOGIC UNITS OF THE BASIS OF BOTANICAL ASSOCIATIONS AND LANDSAT TM SPECTRAL DATA IN THE RIDGE AND VALLEY PROVINCE, PENNSYLVANIA

C. V. PRICE, R. W. BIRNIE (Dartmouth College, Hanover, NM), T. L. LOGAN, B. N. ROCK, and J. PARRISH (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 125-140. refs
(Contract JPL-956937)

Data collected on November 2, 1982 by the Landsat 4 Thematic Mapper (TM) over 72 forested sites in the Ridge and Valley province in Pennsylvania were compared with corresponding botanical and site variable field data. The analysis revealed that both the TM and the botanical data sets can be divided into four groups based on lithology and aspect. Lithology, which is clearly the dominant controlling factor in both sets of data, determines elevation and slope. The aspect (essentially north- and south-facing slope) determines the intensity of solar illumination which affects both the moisture available to the vegetation and the intensity of reflected radiance. Each of the four lithologic/aspect units support unique forest associations, clearly separable both on the basis of ground-based 1/10-acre forest association surveys and on the basis of their TM spectral signatures. I.S.

A86-47811#

PHOTOGEOLOGICAL MAPPING LEADS TO BURIED STRUCTURES IN THE MISSISSIPPI EMBAYMENT

P. D. ERICKSON (Petroleum Information Corp., Littleton, CO) and M. R. CARLISLE (Barrick Exploration Co., Golden, CO) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 169-181. refs

An interpreted combination of color aerial photographs, taken over the Mississippi embayment, and Landsat images were utilized for a geomorphic study conducted for the purpose of locating prospective oil fields. The geomorphic evaluation consisted of four basic parts: the drainage and the landform analyses, the fracture patterns analysis, and the phototonal and color analysis. Features delineated in the geomorphic study as possible hydrocarbon traps were compared with seismic data, obtained to define subsurface within the area of major interest, and with the results of a geochemical survey. Geomorphic expressions of hydrocarbon deposits were substantiated by both seismic profiles and geochemical maps. I.S.

A86-47812#

APPLICATION OF STRUCTURES MAPPED FROM LANDSAT IMAGERY TO EXPLORATION FOR STRATIGRAPHIC TRAPS IN THE PARADOX BASIN

I. S. MERIN and R. C. MICHAEL (Earth Satellite Corp., Chevy Chase, MD) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing For Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 183-192. refs

Using an analysis of Landsat imagery of the integrated Paradox Basin, with aeromagnetic and gravity data, structures believed to mark recurrently active basement fractures were mapped. Landsat imagery revealed faults that, in many places, have offsets too small to be detected seismically. This ability to map faults with a small offset may be particularly valuable in the exploration of algal mounds, because small, fault-related, changes in sea floor bathymetry can produce enough local relief to support the development of algal bioherms. I.S.

A86-47813#

DISCRIMINATION OF ROCK TYPES AND ALTERATION ZONES FROM AIRBORNE MSS DATA - THE SAMRAN-SHAYBAN AND MAHD ADH DHAHAB AREAS OF SAUDI ARABIA

W. P. LOUGHLIN (Hunting Geology and Geophysics, Ltd., Borehamwood, England) and M. A. TAWFIQ (Directorate General for Mineral Resources, Jidda, Saudi Arabia) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA. April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 207-225. refs

A86-47814#

DISCRIMINATION OF IRON OXIDES AND VEGETATION ANOMALIES WITH THE MEIS NARROW BAND IMAGING SYSTEM

S. J. FRASER, A. A. HUNTINGTON, A. A. GREEN, M. R. STACEY, and G. P. ROBERTS (CSIRO, Div. of Mineral Physics, Sydney, Australia) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 233-253. Research supported by the MacDonald Dettwiler and Associates, Ltd., Hamersley Exploration, Mt. Newman Mining Co., Western Mining Corp., Carpentaria Exploration Co., CSR, Ltd., and Geopeko, Ltd. refs

The radiometric sensitivity of the MEIS-II scanner was utilized for the identification and delineating of goethitic and haematitic iron species, and for the detection of mineral-stressed vegetation. The results of several application studies are documented, and the analysis techniques are described. The iron oxide filter bandpasses were chosen to highlight the goethitic shoulder at 0.64 micron and the broad Fe(3+) absorption feature between 0.85 and 1.00 micron. In the Hamersley Iron Province of western Australia, goethite and Haematite have been distinguished spectrally both in open pits and in areas of natural outcrop. At Mary Kathleen in Queensland, the narrow-band iron oxide filter sets have mapped lithological subdivisions not previously recognized and not evident on broad-band images. The vegetation filter bandpasses were chosen to monitor the chlorophyll 'red edge'. At the Washpool vegetation site, considerable spectral variation has been observed. Separating the combined effects of filter 'blue shifts' and species variation from possible shifts to shorter wavelengths of the chlorophyll 'red edge' resulting from metal-stressed vegetation is difficult. Author

A86-47815#

STRUCTURAL AND LITHOLOGICAL MAPPING IN THE WESSEX BASIN OF SOUTHERN ENGLAND USING SEASAT SAR, LANDSAT MSS AND TM DATA

A. D. G. DIXON, T. J. MUNDAY, and S. D. LAKE (Durham, University, England) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 255-264. refs

Optically processed Seasat SAR, MSS and TM and digitally processed Seasat SAR satellite imager was utilized for a geological study of the Wessex Basin of southern England. Many lineaments were found to correspond to major structural elements in the basin, including reactivated basement structures. Analytical comparisons were made between the optical and digital imagery and it was found that each data set revealed important information about the structural development of the basin. Digitally processed Seasat SAR data increased the number of detectable lineaments and interesting results were obtained by operation of the Hue Saturation Intensity transform. The full potential of the remotely sensed data will be realized when used in conjunction with fieldwork and geophysical studies. Author

A86-47816#

MULTISENSOR REMOTE SENSING AS AN EXPLORATION TOOL IN THE COBEQUID MOUNTAINS AREA, NOVA SCOTIA, CANADA

S. D. MELVIN (Gregory Geoscience, Ltd., Ottawa, Canada) and M. S. AKHAVI (Nova Scotia Land Survey Institute, Lawrencetown, Canada) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 265-270. refs

A86-47817#

APPLICATION OF A GEOCODED DATABASE FOR GEOLOGICAL INVESTIGATION AND EXPLORATION

M. S. AKHAVI (Nova Scotia Land Survey Institute, Lawrencetown, Canada) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 271-277. Research supported by the Department of Energy, Mines, and Resources of Canada. refs

Multispectral scanner and Thematic Mapper imagery of Guysborough County, Nova Scotia were investigated to extract spectral reflectance signature pertinent to the classification of plutonic and metasedimentary rocks. A geocoded database was formed by digitizing, overlaying and registering geological, and biophysical information over a Landsat image. Spectral statistics were obtained from each geologic unit. The result indicates that metasediments are spectrally distinct from plutons. Updating of geologic maps included the detection of lineaments and alteration of some contact lines. The database was utilized to target an exploration area on the basis of the relationship between structural deformation and mineral placement. Author

A86-47818#

APPLICATION OF LANDSAT IMAGERY TO HYDROCARBON EXPLORATION IN THE NIOBRARA FORMATION, DENVER BASIN

I. S. MERIN (Earth Satellite Corp., Chevy Chase, MD) and W. R. MOORE IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 279-287. refs

The Landsat imagery of the Niobrara Formation in the Denver basin was used to map the orientation and distribution of fractures in this basin. The map has revealed numerous northeast-trending faults throughout the basin. Many faults overlie older zones that were reactivated during the Laramide orogenic event, suggesting that these lineaments are previously unrecognized fracture zones. Based on an understanding of the regional tectonics, the theoretical motion of a given fracture through time could be predicted. Using this theoretical data as a guide and integrating the Landsat analysis with subsurface well log data, the fracture systems most favorable for prospecting for fracture production of oil were identified. These predictions are substantiated by the location of several apparently productive Niobara wells along a zone of northeast-trending lineaments. I.S.

A86-47819#

INTERACTIVE DIGITAL IMAGE ANALYSIS OF LANDSAT MSS IMAGES FOR MAPPING HYDROTHERMAL LIMONITE

K. LEE (USGS, Denver; Colorado School of Mines, Golden) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 293-307. refs

The paper describes a technique of interactive digital analysis of Landsat MSS images, which separates hydrothermal limonite from other, more abundant limonite anomalies. Ratio data are transformed to Munsell color coordinates, which numerically describe the colors of the RCT and are interactively viewed on a color monitor, allowing the geologist to numerically characterize hydrothermal and other limonite. Further processing eliminates the 'uninteresting' limonite. Application of this methodology to an MSS image of the Colorado Front Range has eliminated limonite images of red beds, alluvial soils, and bedrock with weathered mafic minerals. For an alpine and tundra region of the San Juan Mountains of southwestern Colorado, screening of surficial deposits, combined with vegetation mapping, produced a hydrothermal limonite map with 29 anomalies, all of which were verified in the field to be associated with hydrothermal alteration.

For the desert of Saudi Arabia, these methods separated out extensive limonitic anomalies caused by eolian sand and alluvium, and led to hydrothermal limonite associated with metallic mineral occurrences. I.S.

A86-47820#

ANALYTICAL TECHNIQUES FOR EXTRACTING GEOLOGIC INFORMATION FROM MULTICHANNEL AIRBORNE SPECTRORADIOMETER AND IMAGING SPECTROMETER DATA

F. A. KRUSE, G. L. RAINES, and K. WATSON (USGS, Denver, CO) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 309-324. refs

Several techniques have been developed for the analysis of mineral deposits data obtained by a new high-resolution multichannel airborne spectroradiometer and NASA's Airborne Imaging Spectrometer. The general techniques consist of normalization of spectra to remove albedo and illumination effects, and calculation of reflectance relative to a standard spectrum to identify the minerals. Among the two normalization methods, normalization to one channel and equal-energy normalization, the latter procedure was found to be less affected by individual absorption features. Relative reflectance spectra are computed by dividing spectra by a standard curve. The standard curves were constructed using two techniques: (1) calculating the simple average of all spectra along the flightline or (2) using the low-order terms of a discrete Fourier series to fit each spectrum along the flight line by employing an FFT method. Although the calculated relative reflectance spectra and images do contain artifacts, introduced by the data manipulation procedures, the use of these techniques makes it possible to identify and plot specific minerals, based on their spectral characteristics. I.S.

A86-47823*# Washington Univ., St. Louis, Mo.

GEOBOTANICAL INFORMATION CONTAINED IN LANDSAT THEMATIC MAPPER IMAGES COVERING SOUTHERN MISSOURI

G. GREEN, R. ARVIDSON, M. SULTAN, and E. GUINNESS (Washington University, Saint Louis, MO) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 371-380. NASA-sponsored research. refs

Landsat Thematic Mapper (TM) data collected in the late summer, fall, and winter of 1982 over forested bedrocks in southeastern Missouri were used in conjunction with forest surveys, field work, aerial photographs, and laboratory analyses to evaluate multispectral and seasonal information from visible and reflected IR data. The forested bedrock included granites, rhyolites, carbonates, and sandstones. High reflectance in band 4 (760-900 nm) in the summer scene corresponds to regions of xeric forest type. The fact that the xeric regions tend to develop flat-topped canopies, as opposed to irregular canopy surfaces of the wetter mesic areas, may partially control the TM response in bands 4, 5 (155-175 nm) and 7 (208-235 nm). The xeric regions correlated with soils having poor water retention capabilities, such as rhyolites and certain carbonate rocks with nonporous residum layers. An opposite relationship between xeric and mesic forest biomass was noted, if the commonly used TM band ratio 4/3 was used as a surrogate biomass measure. The high band 4 response over xeric forests gives anomalously high biomass estimates. I.S.

A86-47824#

REMOTE SENSING AND SURFACE GEOCHEMICAL STUDY OF RAILROAD VALLEY NYE COUNTY, NEVADA

V. T. JONES, S. G. BURTELL (Exploration Technologies, Inc., Houston, TX), R. A. HODGSON (Geological Consulting Services, Jamestown, PA), T. WHELAN, C. MILAN (Woodward Clyde Oceaneering, Houston, TX) et al. IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 381-389. refs

A remote sensing and soil gas geochemical survey of Railroad Valley, NV was conducted in order to correlate the existing geochemical anomalies with the locations predicted on the basis of the structural model of Foster and Dolley (1979). In addition, the existing geological structures were related to those obtained by interpreting the remote sensing data. Combined interpretation, using SAR, TM, and TDCS-processed TM images, suggests the presence of major fracture lines which define regional fault and fracture systems. Some of the many fracture lines crossing the valley graben confirm the structural divisions identified by Foster and Dolly. There appears to be a reasonable correlation between the mapped features systems, the geochemical anomalies, and the existing oil fields, although any one set of data alone is not sufficient to delineate the fields. I.S.

A86-47825#

THE IRON ABSORPTION INDEX - A COMPARISON OF RATIO-BASED AND BASELINE-BASED TECHNIQUES FOR THE MAPPING OF IRON OXIDES

N. L. MILLER and C. D. ELVIDGE (Stanford University, CA) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 405-415. refs

A baseline has been established in digital number space which represents the iron oxide free condition for Thematic Mapper (TM) bands one and three. Pixels with iron oxide staining fall away from the baseline due to strong absorptions by iron oxides in the spectral region of TM1. An Iron Absorption Index (IAI) has been developed which directly measures the departure of iron stained pixels from this baseline. The IAI has been compared to the commonly applied TM3/TM1 ratio for the assessment of iron staining and been shown to be much less susceptible to rock-soil brightness variations which strongly affect the formulation of ratio values. Author

A86-47826#

APPLICATION OF REMOTE SENSING IN THE EXPLORATION IRON AND MANGANESE DEPOSITS - A CASE STUDY FROM SANDUR, SOUTHERN INDIA

K. S. SHIVAKUMAR, B. SOMASEKAR (Gulbarga University, Sandur, India), and R. NAGARAJAN (Indian Institute of Technology, Bombay, India) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 427-435. refs

Landsat Four band MSS imagery and false color composites were used in the demarcation of the surficial features of Sandur Schist belt, Southern India. Ridges bordering the schist belt exposed of Iron formations, exhibit antiformal and synformal structure. Morphometric analysis of the ridges, show that the iron ore concentrations occur above 850 m on flat topped plateau, while manganese are above 750 m mostly in the conical shaped ridges. Narihalla fault is confined to the schist belt. Author

A86-47827*# Texas Univ. at Dallas, Richardson.

SPACEBORNE RADAR IMAGERY IN REGIONAL GEOLOGIC MAPPING OF THE SIERRA MADRE ORIENTAL, NORTHEASTERN MEXICO - THE USE OF MORPHOSTRATIGRAPHIC UNITS IN MAPPING BY REMOTE SENSING

J. F. LONGORIA and O. H. JIMENEZ (Texas, University, Richardson) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 437-446. refs
(Contract JPL-956430)

A86-47829*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NEW RESULTS FOR GEOLOGIC UNITS MAPPING OF UTAH TEST SITES USING LANDSAT TM DATA

N. M. SHORT (NASA, Goddard Space Flight Center, Greenbelt, MD) and R. MARCELL (Science Applications Research, Inc., Lanham, MD) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 459-470.

This paper continues a study on the accuracy of geological mapping using Landsat Thematic Mapper data (Short, 1984). In June 1976, both the White Mountain alteration zone and the Waterpocket Fold sedimentary rock sites in Utah were surveyed by the Bendix 24-band scanner on a NASA NC-130B aircraft. Mid-June 1984 TM data for these two sites have been processed like the 1976 data to test the quality of simulation of TM data. Principal-components (PC) color composite images for White Mountain show close correspondence to the Bendix PC images. At this site carbonate strata are uniquely discriminated in both Bendix and TM composites that use an inverted PC 3 image. Alunite/kaolinite and hematite/limonite alteration zones developed on volcanic flows are also sharply separated, but iron oxide and silicified zones are less so. The accuracy of rock-units mapping at the Waterpocket Fold site by supervised classification of the June TM data is significantly better, reaching 70 percent in the best case, than for January 1983 data for that site. Author

A86-47830#

MULTI-SEASONAL IMAGERY STUDIES FOR GEOLOGICAL MAPPING AND PROSPECTING IN CULTIVATED TERRAIN OF S.W. ENGLAND

J. M. JAMES and J. M. MOORE (Imperial College of Science and Technology, London, England) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 475-484. Research supported by the Imperial College of Science and Technology. refs

The use of satellite remote-sensing data to characterize geologically an agricultural region in SW England is discussed. The geology and geomorphology of the region are reviewed; the database, comprising Landsat MSS images from all four seasons and optically correlated Seasat SAR images, is described; the image-processing techniques employed (including linear stretching, high-pass filtration, false-color composites, and negative and threshold images) are explained; and sample images are compared with geological maps. It is found that images combining MSS bands 4, 5, and 7 obtained at low sun angles (less than 15 deg) during winter periods with snow cover are most useful in revealing tectonic fabric and lithology, and that SAR images complement winter MSS images due to the eastward direction of the Seasat radar antenna. T.K.

A86-47831#

STRUCTURAL ANALYSIS OF THE CEVENNES (FRANCE) USING LANDSAT, SPACELAB, GEOPHYSICAL AND FIELD DATA

A. BLUSSON (IBM France, S.A., Paris; Paris XI, Universite, Orsay, France) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 487-496. refs

The Cevennes region (southern France) is a geologically well known region. The NE-SW fault-trending zone which crosses the region is of great tectonic interest, considering its position between the Alps and the Pyrenees. A comparative study of Landsat and Spacelab interpretations was associated with geophysical data, existing maps, and field microtectonics measurements. This comparison was qualitatively represented with polar histograms and shows that, in spite of the good quality of the results obtained from Landsat data, the higher quality of Spacelab photographs is an important resource for geological photointerpretation. It is also found that automatic methods provide a good contribution to tectonic studies by remote sensing. Geophysical data give a third dimension to this study. Author

A86-47832#

REMOTE SENSING APPLICATION FOR LOCATING BAUXITE ORE PATS' OF THE EASTERN GHATS OF ANDHRA PRADESH, INDIAN UTILISING GEOBOTANICAL AND ENVIRONMENTAL DATA

R. S. RAO and S. SUDHAKAR (Andhra University, Visakhapatnam, India) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 499-510. Research supported by Andhra University. refs

A86-47833#

LANDSAT THEMATIC MAPPER AND SEASAT SAR DATA FOR MAPPING DESERT ALLUVIAL DEPOSITS

P. M. MERIFIELD (Lamar-Merifield Geologists, Inc., Santa Monica, CA) and W. W. YANG (California, University, Los Angeles) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 521-529. refs

Landsat 4 Thematic Mapper (TM) data used in conjunction with Seasat SAR data are useful in discriminating alluvial deposits in desert regions. A number of images of Chuckwalla Valley in the southeastern Mojave Desert were generated combining selected TM bands and Seasat SAR data. Compositional differences are brought out by a color composite image in which TM band 5 is projected in red and TM band ratios 3/1 and 4/3 are projected in green and blue, respectively. Older alluvial units of different clast size that are coated with desert varnish cannot be separated using Landsat data alone, but the Seasat component permits distinction among varnished surfaces with small variation in surface roughness. Stone pavements in various stages of development, for example, can be distinguished. A useful image was generated by digitally coregistering Seasat SAR data with a TM scene and projecting TM Band 2 in red, TM Band 7 in green, and Seasat SAR in blue. The rougher the surface, the brighter the blue component appears. The greater spatial resolution of the Landsat 4 Thematic Mapper data enables mapping at scales as large as 1:62,500. Field data, including spectral measurements with a Barringer Hand-Held Reflectance Radiometer (HHRR) and roughness measurements with a mechanical profiler, were made to provide a quantitative comparison of the units mappable from the imagery. Author

A86-47834#

INTERPRETATION OF ENHANCED TM DATA FOR MEDIUM-SCALE GEOLOGICAL MAPPING IN GLACIATED FORESTED TERRAINS - ONTARIO CASE STUDY

V. H. SINGHROY, T. J. ELLIS (Ministry of Natural Resources, Ontario Centre for Remote Sensing, Toronto, Canada), and D. JANES (Ministry of Northern Affairs, Ontario Geological Survey, Sioux Lookout, Canada) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 531-538. refs

A86-47835#

RADAR IMAGE ANALYSIS FOR MAPPING CENTRAL APPALACHIAN CROSS-STRIKE STRUCTURAL DISCONTINUITIES

C. S. SOUTHWORTH (USGS, Reston, VA) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 539-551. refs

Two cross-strike structural discontinuities (CSD's) in the central Appalachians of Virginia and West Virginia have been identified by photointerpretation of side-looking airborne X-band radar images in conjunction with field mapping. CSD's were defined by Wheeler (1980) as structural lineaments or alignments, at high angles to regional strikes, that are recognizable because they disrupt strike-parallel structural, geomorphic, geophysical, sedimentologic, or other patterns. The Mathias (West Virginia) CSD and the Highland County (Virginia) CSD both trend northwest across the northeast-striking Valley and Ridge Province Appalachians and are believed to represent transverse movement of detachment surfaces, possibly over basement block faults. The concentrations of igneous intrusive rocks and the terminations of gas fields associated with the CSD's suggest that they are important in targetting areas for mineral and hydrocarbon exploration. Geologic and geophysical data suggest that the zones have been intermittently active throughout geologic time and that the zones traverse adjacent physiographic provinces. Author

A86-47836#

MICROWAVE RADIOMETRIC DETECTION AND IMAGING OF OIL SPILLS ON THE SEA

S. HASHIMOTO, H. NAKANO, and M. YAMAGUCHI (Ministry of International Trade and Industry, Electrotechnical Laboratory, Amagasaki, Japan) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 557-565. Research sponsored by the Environment Agency of Japan.

Microwave radiometric detection of oil spills could provide useful information on the distribution of oil film thickness which is practically most important in effective oil confinement, control and clean-up operation. To use for experimental investigation of oil spill detection and mapping, a radiometer and imaging system have been developed, which can operate at both X-band and K-band frequencies by replacing the front-end. Through the measurements of oil slicks of several types, good correlation of the measured results and theory has been obtained. The effect of waves or surface roughness effect on the detection of oil were measured using a laboratory tank. The results provide a quantitative estimation of the effect. Several examples of color imageries taken by the above sensor system are also given. Author

A86-47837#

REMOTE SENSING AS AN AID IN PLANNING REGIONAL GEOCHEMICAL SURVEYS IN THE CANADIAN SHIELD

J. A. C. FORTESCUE (Ministry of Northern Affairs, Ontario Geological Survey, Toronto, Canada) and V. H. SINGHROY (Ministry of Natural Resources, Ontario Centre for Remote Sensing, Toronto, Canada) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 567-575.

In August 1984, a small limnology/remote sensing study was completed to the south of the Montreal River in the area to the east of Lake Superior, Ontario. The object was to discover if lakes with an acidity of less than a pH of 5.6 could be identified by remote sensing. This relationship was investigated using synchronous limnological, fixed-wing and helicopter mounted remote sensing surveys over the test area. Subsequent interpretation of the data sets collected from the test site indicates that such identifications might be feasible using Landsat 5 Thematic Mapper data. Author

A86-47839#

THE DISCRIMINATION OF POTENTIALLY ECONOMIC PALAEODRAINAGE SYSTEMS IN THE SEDIMENTARY BASINS OF CENTRAL AND WESTERN AUSTRALIA USING NOAA-AVHRR IMAGERY

I. J. TAPLEY (CSIRO, Div. of Groundwater Research, Wembley, Australia) and P. WILSON (CSIRO, Div. of Mineralogy and Geochemistry, Wembley, Australia) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 585-600. refs

A86-47841*# Cornell Univ., Ithaca, N.Y.

LITHOLOGIC DISCRIMINATION OF VOLCANIC AND SEDIMENTARY ROCKS BY SPECTRAL EXAMINATION OF LANDSAT TM DATA FROM THE PUMA, CENTRAL ANDES MOUNTAINS

E. J. FIELDING (Cornell University, Ithaca, NY) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 619-630. refs

(Contract JPL-956926; NSF EAR-81-21816; NASA TASK RE-185)

The Central Andes are widely used as a modern example of noncollisional mountain-building processes. The Puna is a high plateau in the Chilean and Argentine Central Andes extending southward from the altiplano of Bolivia and Peru. Young tectonic and volcanic features are well exposed on the surface of the arid Puna, making them prime targets for the application of high-resolution space imagery such as Shuttle Imaging Radar B and Landsat Thematic Mapper (TM). Two TM scene quadrants from this area are analyzed using interactive color image processing, examination, and automated classification algorithms. The large volumes of these high-resolution datasets require significantly different techniques than have been used previously for the interpretation of Landsat MSS data. Preliminary results include the determination of the radiance spectra of several volcanic and sedimentary rock units and the use of the spectra for automated classification. Structural interpretations have revealed several previously unknown folds in late Tertiary strata, and key zones have been targeted to be investigated in the field. The synoptic view of space imagery is already filling a critical gap between low-resolution geophysical data and traditional geologic field mapping in the reconnaissance study of poorly mapped mountain frontiers such as the Puna. Author

A86-47843#

APPLICATION OF THEMATIC MAPPER DATA FOR HYDROCARBON EXPLORATION IN THE HARDEMAN BASIN OF NORTH TEXAS

V. S. MOORE and R. L. ANDERSON (Satellite Exploration Consultants, Inc., Midland, TX) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 645-653. refs

Exploration in the Hardeman Basin has been difficult because of the small, localized nature of traps and a poorly understood relationship between regional structure and production. This paper demonstrates the effectiveness of Landsat Thematic Mapper (TM) data as an exploration tool in this basin. Regional as well as local structures are defined on TM images as lineaments, tonal anomalies, and topographic anomalies. Anomalies observed over the basin's major structures are best identified on small-scale images. Other smaller more subtle anomalies, such as those formed over bioherms, require large-scale images for identification. An exploration program using information derived from the TM data involves the identification of production trends and the development of models based on anomalies observed over producing structures that can be used to delineate potential prospect areas. Author

A86-47844*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SHUTTLE RADAR IMAGES FOR GEOLOGIC MAPPING IN TROPICAL RAINFOREST

J. P. FORD (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) and R. DA CUNHA (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 669-676. NASA-supported research.

Images of forested low-relief terrain in the Amazon basin of Brazil, obtained with airborne imaging radar in the Radambrasil project, are compared with SIR-A and Landsat MSS band-7 images to evaluate their usefulness in constructing geologic maps. Sample images are shown, and it is found that Radam images are more useful in distinguishing drainage patterns and mapping the region distribution of stream channels due to their relatively low depression angles (less than 25 deg as opposed to 43-37 deg for SIR-A), but that SIR-A images give superior discrimination of alluvial forest, where trees stand in water, due to the higher reflectivity of branches and water at the SIR-A wavelength (23.5 cm as opposed to 3 cm for Radam). Alluvial forest is also identified by Landsat band 7. T.K.

A86-47847#

SPECTRAL GEOBOTANY IN GLACIATED ENVIRONMENTS - TEST OVER A MINERALIZED TILL SITE IN NORTHERN ONTARIO

V. H. SINGHROY (Ministry of Natural Resources, Ontario Centre for Remote Sensing, Toronto, Canada), E. SADO (Ministry of Northern Affairs, Ontario Geological Survey, Toronto, Canada), and W. BRUCE (Canada Centre for Remote Sensing, Ottawa) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 701-720. refs

A86-47848#

A CONTINUED STUDY OF THE PATRICK DRAW TEST SITE SWEETWATER COUNTY, WYOMING

D. M. RICHERS (Gulf Research and Development Co., Houston, TX) and C. WEATHERBY (Adrian College, MI) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 723-733. refs

A Landsat-D-Simulator image of the Patrick Draw area, a region with oil and gas fields where microseepage of light hydrocarbon gases from subsurface reservoirs has been observed, is presented and analyzed on the basis of ground-truth data including free, acid-extractable, and disaggregated soil-gas samples; 365-nm-fluorescence measurements on soil samples; and observations of vegetation patterns. Spectral anomalies on the Landsat-Simulator image are found to correspond to areas with high gas seepage and damaged vegetation cover, centered on the main oil/gas production fields; good correlation is also found with the fluorescence data. It is suggested that the spectral anomalies may be due either to the differences in the flora or to differences in the soil itself. T.K.

A86-47849#

MULTIPLE SOURCE DATA PROCESSING FOR REGIONAL GEOLOGIC ANALYSIS

V. CARRERE and P. T. NGUYEN (IBM France, S.A., Paris) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 735-744. refs

A structural analysis of a region in southeastern France is presented. Satellite data (a digital mosaic of five Landsat images and IR data from HCMM), topographic data (DTM), and a digitized gravimetric map are registered and placed in a geocoded data base (Lambert projection). Landsat data are primarily used to detect linear structures and then directionally filtered to enhance the main structural features. The same method is applied to HCMM data, and a first comparison is made to check whether features detected are confirmed, linked, or extended by thermal properties, and to make a first selection between superficial accidents in the sedimentary cover and deeper ones. Correlations with strong gradient limits or elongated inclusions on the gravimetric data give more information on faults affecting the basement. The processed data and their interpretations add pertinent elements to the interpretation of the geodynamic evolution of southeastern France. Author

A86-47850#

TOWARD INTELLIGENT IMAGE PROCESSING FOR GEOLOGICAL APPLICATIONS

M. FENG (Beijing Graduate School, Beijing; Wuhan College of Geology, People's Republic of China) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 745-754. Research sponsored by the National Science Foundation of the People's Republic of China. refs

This paper reports early results of a research project on Landsat-image processing sponsored by the National Science Foundation of China. The goal of the project is to provide China's geological-remote-sensing community with guidelines to more efficiently and effectively use the growing image-processing capacity in China to produce optimum image products to meet their specific requirements. To characterize the information content of a single image (either a band, a ratio, or a principal component) and its significance in geological interpretation, a concept of information ranking is presented. Geologically related spectral information in an image can generally be stratified into three or more ranks or levels. Image enhancement, in a sense, means

selective display of certain ranks of information. While band ratios and linear transformations enhance spectral separation, different ratios and different linear combinations work differently in terms of information ranks. Four examples from different physiographic areas of China are selected to illustrate this important point and its use in selection of image combinations for color compositing.
Author

A86-47851#
SPATIAL RELATIONSHIP OF GOLD OCCURRENCES WITH LINEAMENTS DERIVED FROM LANDSAT AND SEASAT IMAGERY, MEGUMA GROUP, NOVA SCOTIA
G. F. BONHAM-CARTER, A. N. RENCZ (Geological Survey of Canada, Ottawa), and J. R. HARRIS (F.G. Bercha and Associates, Ltd., Ottawa, Canada) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 755-768. refs

A86-47852#
MAPPING STRUCTURE AND RELATED GEOBOTANICAL PHENOMENA USING SEVERAL DATES OF LANDSAT IMAGERY, RAILROAD VALLEY, NEVADA
R. O. GREEN and D. A. ROBERTS (Stanford University, CA) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 771-780. refs

A86-47853#
AIRBORNE THERMAL INFRA-RED LINESCAN IN GEOLOGY
B. C. TANDY and E. AMOS (Clyde Surveys, Ltd., Maidenhead, England) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 783-792.

The use of airborne-IR-scanning data for geological mapping and surveying is discussed and illustrated with sample images, graphs, and diagrams. The fundamental principles of the IR-scanning technique are reviewed; factors determining the IR signatures of geological formations are examined; and applications involving structural control and mineralization, hot thermal mineral indicators, bulk mineral assessment, engineering planning, geothermal energy, and hydrogeology are briefly characterized.
T.K.

A86-48084
RECTANGULAR HARMONIC ANALYSES OF GEOMAGNETIC ANOMALIES DERIVED FROM MAGSAT DATA OVER THE AREA OF THE JAPANESE ISLANDS
I. NAKAGAWA and T. YUKUTAKE (Tokyo, University, Japan) Journal of Geomagnetism and Geoelectricity (ISSN 0022-1392), vol. 37, no. 10, 1985, p. 957-977. refs

A86-48394
GEOLOGICAL REMOTE SENSING - QUO VADIS?
C. WEBER (Bureau de Recherches Geologiques et Minieres, Orleans, France) ITC Journal (ISSN 0303-2434), no. 4, 1985, p. 227-241. refs

The uses of remote sensing techniques in the areas of geological mapping, oil exploration, mineral exploration, and engineering technology are discussed, together with the major directions of research in these areas. Applications of the Landsat MSS imagery, the TM, the Shuttle multispectral infrared radiometer, the SAR, the imaging radars mounted on the SIR-A and SIR-B satellites, and the stereoscopic capability of SPOT are described. Examples are presented concerning the use of the heat capacity mapping mission for petroleum exploration and the use of Landsat MSS data in detecting hydrothermal alterations associated with deposits of copper, gold, and uranium. Advances made in the assessment of natural hazards with the use of remote sensing technology are discussed.
I.S.

A86-49279
GEOMORPHOLOGICAL MANIFESTATION OF OIL- AND GAS-BEARING LOCAL STRUCTURES IN THE ORENBURG DISTRICT ON SPACE IMAGES [GEOMORFOLOGICHESKOE VYRAZHENIE NEFTEGAZOVYKH LOKAL'NYKH STRUKTUR ORENBURGSKOI OBLASTI NA KOSMICHESKIKH SNIMKAKH]
N. N. IAKHIMOVICH (Vsesoiuznyi Nauchno-Issledovatel'skii Geologorazvedochnyi Neftianoi Institut, Orenburg, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1986, p. 32-38. In Russian. refs

A86-49280
INTERPRETATION OF GEOLOGICAL INDICATORS ON SPACE PHOTOGRAPHS TAKEN IN THE COURSE OF OIL AND GAS EXPLORATIONS IN THE LATITUDINAL STRETCH OF THE OB' RIVER AREA AND ADJACENT TERRITORIES OF WESTERN SIBERIA [GEOINDIKATSIONNOE DESHIFRIROVANIE AEROKOSMICHESKIKH SNIMKOV PRI NEFTEGAZOPOISKOVYKH RABOTAKH V SHIROTNOM PRIOB'E I NA SOPREDEL'NYKH PLOSHCHADIAKH ZAPADNOI SIBIRI]
B. M. GUSHCHIN (Institut Geologii i Razrabotki Goriuchikh Iskopaemykh, Kiev, Ukrainian SSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1986, p. 41-49. In Russian.

A86-49315
A STUDY OF THE EFFICIENCY OF SPATIAL DIFFERENTIATION OPERATIONS DURING THE GEOLOGICAL INTERPRETATION OF AERIAL AND SATELLITE PHOTOGRAPHS [ISSLEDOVANIE EFFEKTIVNOSTI ISPOL'ZOVANIIA OPERATSII PROSTRANSTVENNOGO DIFFERENTSIROVANIIA PRI GEOLOGICHESKOM DESHIFRIROVANII AEROKOSMOFOTOSNIMKOV]
R. S. BACHEVSKII, G. I. GASKEVICH, L. I. MURAVSKII, and D. A. IANUTSH IN: Optical processing of images . Leningrad, Izdatel'stvo Nauka, 1985, p. 3-18. In Russian.

A86-49512
AIRPHOTO OBSERVATION OF TRANSCURRENT NEOTECTONICS AT THE NORTHERN EDGE OF THE CARIBBEAN PLATE (CABO FALSO, DOMINICAN REPUBLIC) [OBSERVATION PAR PHOTOGRAPHIES AERIENNES D'UNE NEOTECTONIQUE EN DECROCHEMENT AUX CONFINS SEPTENTRIONAUX DE LA PLAQUE CARAIBE /CABO FALSO, REPUBLIQUE DOMINICAINE/]
B. VAN DEN BERGHE and J. CHOROWICZ (Paris VI, Universite, France) Photo Interpretation (ISSN 0031-8523), vol. 24, Jan.-Feb. 1985, p. 17-21, 23, 25. In French, English, and Spanish.

A86-49605#
STRUCTURAL ANALYSIS ON THE BASIS OF DIGITAL PROCESSED SATELLITE IMAGERY DATA REGARDING THE BASEMENT OF NORTHEAST BAVARIA [STRUKTURANALYSE MIT DIGITAL VERARBEITETEN SATELLITENBILDDATEN IM NORDOSTBAYERISCHEN GRUNDGEBIRGE]
D. KAISER, J. KUHLMANN, L. WAEBER (Saarberg-Interplan Uran GmbH, Saarbruecken, West Germany), and D. SCHLICHTER (DFVLR, Wessling, West Germany) BMFT, Statusseminar ueber die Nutzung von Fernerkundungsdaten in der Bundesrepublic Deutschland, Garmisch-Partenkirchen, West Germany, Jan. 20-22, 1986, Paper. 14 p. In German. BMFT-supported research. refs

The project considered in this paper has the objective to develop and test remote sensing techniques for the exploration of uranium vein-type deposits, taking into account a study of representative uranium deposits in Bavaria, West Germany. The new image processing method is to provide a basis for a more rapid recognition of uranium deposits in large areas, giving attention also to a fast evaluation of the economic potential of the deposits. In addition, the new method is to contribute to the aim of an optimized control of the subsequent exploration program. Other aims to be considered are related to a reduction in specific exploration costs, and the lowering of the technological-economic risk involved in the exploration. It is also expected that the developed methodology can be applied in cases involving geologically comparable areas in other climatic zones. G.R.

A86-49768
USE OF SPACE REMOTE-SENSING DATA FOR GEOLOGICAL STUDIES IN THE TROPICS [OPYT GEOLOGICHESKOGO PRIMENENIIA AEROKOSMICHESKIKH MATERIALOV V TROPICHESKIKH USLOVIIAKH]
V. G. TRIFONOV, I. ORO ALFONSO, and C. PERES PERES (AN SSSR, Geologicheskii Institut, Moscow, USSR; Academia de Ciencias de Cuba, Instituto de Geologia y Paleontologia, Havana) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1986, p. 38-43. In Russian. refs

Geological structures identified by analyzing remote-sensing images of western Cuba were correlated with features on geological maps compiled (on a 1:250,000 scale) on the basis of a geological survey. The interpreted images were particularly useful in identifying postfolding orogenic structures formed at the second stage of deformation, which were poorly visible on geological maps. Hydrothermal sulfide deposites can be correlated with the interpreted ring structures formed during the same period. I.S.

A86-49769
THE USE OF SPACE PHOTOGRAPHY IN STUDIES OF SEISMICITY [PRIMENENIE KOSMICHESKIKH SNIMKOV PRI IZUCHENII SEISMICHNOSTI]
V. P. LOZIEV and M. S. SAIDOV (Gosudarstvennyi Nauchno-Issledovatel'skii i Proizuodstvennyi Tsentr Priroda, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1986, p. 50-53. In Russian. refs

The characteristic structural and geomorphological signatures, visible on space images which can identify areas of high seismicity, are described, on the example of a sector of the Alai mountain range. These structures can be recognized on space photographs, being coincident with the areas of dense tectonic fractures that cross zones of seismogenic faults, or with narrowing river valleys. They are emphasized by developing landslides. I.S.

N86-28494# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
THE USE OF SAR SYSTEMS FOR GEOLOGICAL APPLICATIONS
F. JASKOLLA (Ludwig-Maximilians-Universitaet, Munich, West Germany), M. RAST, and J. BODECHTEL *In its* Proceedings of a Workshop on Thematic Applications of SAR Data p 41-50 Dec. 1985
Avail: NTIS HC A06/MF A01

Radar imagery was used for gelogical mapping in Southern Iceland, Bavaria, Italy, and Egypt. Radar data enables an improved identification of lithological units and structural features. Experiments on the information content of simultaneously collected X, C, and L-band data are needed. The application of radargrammetric correction is of great importance. ESA

N86-28557*# Oxford Univ. (England). Dept. of Earth Sciences.
PB ISOTOPIC EVIDENCE FOR EARLY ARCHAEAN CRUST IN SOUTH GREENLAND
P. N. TAYLOR and F. KALSBEEK (Geological Survey of Greenland, Copenhagen, Denmark) *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks p 103-106 1986
Avail: NTIS HC A09/MF A01 CSCL 08G

The results of an isotopic remote sensing study focussed on delineating the extent of Early Archean crust north and south of the Nuuk area and in south Greenland is presented. Contamination of the Late Archean Nuk gneisses and equivalents by unradiogenic Pb uniquely characteristic of Amitsoq gneiss was detected as far south as Sermilik about 70 km south of Nuuk and only as far north as the mouth of Godthabsfjord. This study was extended to the southern part of the Archean craton and the adjoining Early Proterozoic Ketilidian orogenic belt where the Pb isotopes suggest several episodes of reworking of older uranium depleted continental crust. The technique of using the Pb isotope character of younger felsic rocks, in this case Late Archean and Early Proterozoic gneisses and granites to sense the age and isotopic character of older components, is a particularly powerful tool for reconstructing the evolutionary growth and development of continental crust. Author

N86-28559*# Atammik, Sukkertoppen (Greenland).
THE ARCHEAN GEOLOGY OF THE GODTHABSFJORD REGION, SOUTHERN WEST GREENLAND (INCLUDES EXCURSION GUIDE)
V. R. MCGREGOR, A. P. NUTMAN (Memorial Univ. of Newfoundland, St. Johns), and C. R. L. FRIEND (Oxford Polytechnic, England) *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks p 113-169 1986
Avail: NTIS HC A09/MF A01 CSCL 08G

The part of the West Greenland Archean gneiss complex centered around Godthabsfjord and extending from Isukasia in the north to south Faeringehavn is studied. Extensive outcrops of 3800 to 3400 Ma rocks can provide some direct evidence of conditions and processes that operated on the Earth in the early Archean. However, the ways in which primary characteristics have been modified by later deformation, metamorphism, and chemical changes are first taken into account. The rocks exposed are the products of two major phases of accretion of continental crust, at 3800 to 3700 Ma and 3100 to 29 Ma. The main features of these two accretion phases are similar, but careful study of the least modified rocks may reveal differences related to changes in the Earth in the intervening period. The combination of excellent exposure over an extensive area, relatively detailed geological mapping of much of the region, and a considerable volume of isotopic and other geochemical data gives special insights into processes that operated at moderately deep levels of the crust in the Archean. Of particular interest is the effect of late Archean granulite facies metamorphism on early Archean rocks, especially the extent to which isotope systems were disturbed. Similar processes may well have partly or wholly destroyed evidence of more ancient components of other high grade terrains. This account does not attempt to be an exhaustive review of all work carried out on the geology of the region. Rather, it attempts to summarize aspects of the geology and some interest in the context of early crustal genesis. Author

N86-28572# Kanner (Leo) Associates, Redwood City, Calif.
EXCITATION OF ELECTROSTATIC WAVE TURBULENCE IN IONOSPHERE AS ONE EFFECT OF SEISMIC ACTIVITY
M. B. GOKHBERG, I. L. GUFELD, A. V. KUSTOV, V. A. LIPEROVSKII, A. M. BULOSHNIKOV, V. A. PILIPENKO, O. A. POKHOTELOV, and S. L. SHALIMOV 1985 41 p Transl. into ENGLISH of "Vozbuzhdenie Elektrostaticheskoi Volnovoi Turbulentnosti v Ionosfere Kak Odin iz Effektov Seismicheskoi Aktivnosti" Preprint no. 16 Moscow, USSR, 1983
(Contract W-7405-ENG-36)
(TI86-025135; LA-TR-85-62) Avail: NTIS HC A03/MF A01

A possible scenario of the buildup of a chain of geophysical phenomena is proposed associating processes in terra firma in the concluding stage of earthquake presaging and bursts of wave turbulence in the ionosphere observed on satellites. Author

N86-30248# International Centre for Theoretical Physics, Trieste (Italy).
GEM 10B SATELLITE GRAVITY DATA AND NIGERIAN OIL PROSPECTS
S. C. GARDE and W. Y. KIM Nov. 1984 11 p
(DE86-701366; IC-84/202) Avail: NTIS (US Sales Only) HC A02/MF A01

Extension of the hydrocarbon rich Benue depression and the Niger delta basin in the bight of Benin is construed from the gravity data of gravity Earth Model (GEM) 10B Satellite, published by NASA, Goddard Space Flight Center in 1977. This interpretation is based on the supposition that: 1) the depth of a buried horizontal cylinder can be estimated by the Fourier transform of the vertical gravity field; and 2) the oil horizons of southern Nigeria are basically connected to the separation of South American and African plates. DOE

N86-31088# Technische Univ., Clausthal-Zellerfeld (West Germany). Inst. fuer Geologie und Palaeontologie.

GEOLOGY

P. KRONBERG and P. MURINO (Naples Univ., Italy) *In* DFVLR The X-SAR Science Plan p 43-74 Nov. 1985
Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 32

Experiments to study how spaceborne imaging radar can improve geological mapping capability and capacity are proposed for the X-SAR/SIR-C mission. Complementary data X-SAR-type imagery can provide at regional to global scales as compared to information from Landsat sensors is discussed. Expected information on rocks, soils, and structures is assessed. Effect of radar operating parameters (illumination geometry, frequency, and polarization) on radar backscatter of rock units and surficial deposits in diverse type of terrain (arid, semi-arid, Mediterranean, humid, tropical areas; plains, rolling country, hilly and mountainous terrain) is considered. Test areas to evaluate the application potential of multifrequency, multipolarization, and multi-incidence-angle imagery for regional and global geological mapping projects are suggested. ESA

N86-31158*# Arizona Bureau of Geology and Mineral Technology, Tucson.

CENOZOIC EXTENSION AND MAGMATISM IN ARIZONA

S. J. REYNOLDS and J. E. SPENCER *In* Lunar and Planetary Inst. Papers Presented to the Conference on Heat and Detachment in Crustal Extension on Continents and Planets p 128 - 132 1985
Avail: NTIS HC A08/MF A01 CSCL 08G

The Basin and Range Province of Arizona was the site of two episodes of Cenozoic extension that can be distinguished on the basis of timing, direction and style of extension, and associated magmatism. The first episode of extension occurred during Oligocene to mid-Miocene time and resulted in the formation of low-angle detachment faults, ductile shear zones (metamorphic core complexes), and regional domains of tilted fault blocks. Evidence for extreme middle Tertiary crustal extension in a NE to SW to SW to ENE to WSW direction has been recognized in various parts of the Basin and Range of Arizona, especially in the Lake Mead area and along the belt of metamorphic core complexes that crosses southern Arizona from Parker to Tucson. New geologic mapping and scrutiny of published geologic maps indicates that significant middle Tertiary extension is more widely distributed than previously thought. The state can be subdivided into regional tilt-block domains in which middle Tertiary rocks dip consistently in one direction. The dip direction in any tilt-block domain is generally toward the breakaway of a low-angle detachment fault that underlies the tilt-block domain; we interpret this an indicating that normal faults in the upper plate of a detechment fault are generally synthetic, rather than antithetic, with respect to the detachment fault. Author

N86-31967# Environmental Research Inst. of Michigan, Ann Arbor. Radar Div.

THE USGS (US GEOLOGICAL SURVEY) X-, C-, AND L- BAND SAR DATA COLLECTION PROGRAM Topic Report, Nov. 1983 - Aug. 1985

E. S. KASISCHKE Aug. 1985 121 p
(Contract DI-14-08-0001-21748)
(AD-A168173; ERIM-173000-4-T) Avail: NTIS HC A06/MF A01 CSCL 17I

This report presents the results of data collection program performed for the U.S. Geological Survey. Twenty-two passes of high resolution (3m), multifrequency (X-, C- and L-band) and multipolarization (VV and VH) imagery were collected over five test sites within the North Carolina Digital Project Area. The SAR used for this program was the ERIM/CCRS CV-580 SAR System. This report presents diagrams of the ground swath of each SAR pass, along with representative SAR imagery which illustrates the high quality of the data set. The engineering assessment performed on the SAR imagery is discussed. The optical and digital SAR data products generated for this program are summarized, including the first-order geometric and radiometric corrections applied to the digital data. GRA

N86-31968# Geological Survey, Sioux Falls, S. Dak.

DIGITAL PROCESSING OF LANDSAT TM IMAGES FOR LINEAMENT OCCURRENCE AND SPATIAL FREQUENCY IN SEDIMENTARY ROCKS

G. K. MOORE and D. A. HASTINGS 1986 33 p
(Contract DE-AI05-85OR-21552)
(DE86-009834; DOE/OR-21552/1) Avail: NTIS HC A03/MF A01

This report describes and evaluates procedures for the enhancement and extraction of lineament segments by computer processing of digital Landsat Thematic Mapper data. Nearly all results were obtained by convolution of filter windows in the spatial domain. During the course of the study several new procedures were developed for image enhancement, directional enhancement, and the extraction of edge and line segments from directionally-filtered images. The standard procedure proved satisfactory for an extraction of prominent edges and lines in the Landsat images. Part of the problem is caused by the landscape and illumination characteristics of the selected images, but another part is caused by the fact that many boundaries are gradational and do not fit a simple mathematical description of edges and lines. Because of this problem, extraced segments in shale outcrop areas were not compared with those in other types of sedimentary rocks, and measurements of the spatial frequency of occurrence of these segments have a questionable value. A possible solution to the problems found by this study would be: (1) to use a combination of digital elevation data and digital remotely-sensed data of the same area; and (2) to combine directional enhancement and lineament segment extraction with visual detection, screening, and editing. DOE

N86-32803 Centre National de la Recherche Scientifique, Grenoble (France).

SEISMOLOGICAL DATA ACQUISITION BY SATELLITE [COLLECTE DE DONNEES SISMOLOGIQUES PAR SATELLITE]

G. POUPINET *In its* International Geophysics and Space p 591-598 1985 In FRENCH
Avail: CEPADUES, Toulouse, France

The use of the INTELSAT, GOES, GMS, ARGOS, and Meteosat networks for geophysical data transmission is discussed. The needs of seismological stations incorporated in satellite networks, are assessed, and the SEISPACE network, which transmits seismological data by satellites, is presented. ESA

N86-32856# Strathclyde Univ., Glasgow (Scotland). Dept. of Applied Geology.

REMOTE SENSING OF NATURAL GEOLOGICAL HAZARDS IN THE SITING OF ENGINEERING FACILITIES

C. A. DAVENPORT *In* ESA Remote Sensing Applications in Civil Engineering p 139-142 Mar. 1985
Avail: NTIS HC A06/MF A01

Hazards to civil engineering facilities produced by active surface faulting and volcanism are reviewed, emphasizing site selection and design criteria in nuclear power plant safety studies. Phenomena sought during regional and local site investigations are described and remotely sensed data which can be applied to these investigations are grouped to provide an optimum-input scheme for siting studies. Lineaments, morphotectonics, geological offsets, fault traces, deformation zones and appurtenant landslides are illustrated to provide details of important geological hazards and to document satellite and aerial imagery and photography, radiometry, moving and time-lapse film techniques, and seismological records. ESA

05

OCEANOGRAPHY AND MARINE RESOURCES

Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location.

A86-40316

AIRBORNE LIDAR BATHYMETRY

K. MUIRHEAD and A. P. CRACKNELL (Dundee, University, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, May 1986, p. 597-614. Research supported by the Royal Aircraft Establishment. refs

Through an extensive literature review the results of previous lidar investigations in Australia, Canada, Sweden, the U.S.A. and West Germany have been evaluated. Based on these findings estimates are given for the anticipated depth capability, measurement accuracy and operational constraints for a laser system in U.K. waters. Consideration is also given to the possibility of deploying a depth-sounding lidar for non-bathymetric purposes such as depth-resolved turbidity mapping. Author

A86-40318

WHITECAPS AND THE PASSIVE REMOTE SENSING OF THE OCEAN SURFACE

E. C. MONAHAN and I. G. OMUIRCHEARTAIGH (University College, Galway, Ireland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, May 1986, p. 627-642. refs
(Contract NR PROJECT 211-229; N00014-85-M-0065; N00014-78-G-0052)

Whitecap coverage (W), which influences the apparent microwave brightness temperature and short-wave albedo of the sea surface, is not only a strongly nonlinear function of the 10 m-elevation wind speed (U), but also varies with changes in the stability of the lower atmosphere (i.e. with alterations in the water-air temperature difference Delta-T), and with changes in the surface-sea water temperature (T sub w). Thus wind retrieval algorithms to be applied to open ocean data from whitecap-detecting satellite instruments should ideally be of the form, U(W, Delta-T, T sub w, d), where d is a measure of the effective wind duration. The wind speed associated with the onset of whitecapping, while also varying with Delta-T and T sub w, is typically 3 to 3.5 m/s, not the often quoted 7 m/s. Author

A86-40319

AN ALGORITHM FOR THE RETRIEVAL OF SEDIMENT CONTENT IN TURBID COASTAL WATER FROM CZCS DATA

S. TASSAN and B. STURM (CEC, Joint Research Centre, Ispra, Italy) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, May 1986, p. 643-655. refs

The retrieval variable and algorithm for the retrieval of sediment content are developed using numerical simulations and sensitivity analyses. A model for calculating the spectral irradiance reflectance of water as a function of pigment, seston, and yellow substance concentration is presented. The algorithm is applied to the study of Coastal Zone Color Scaner images of the Adriatic Sea in order to evaluate the low sensitivity of the sediment retrieval variable to the radiance value of the atmospheric correction algorithm. Two water types in the northern basin of the Adriatic Sea are identified; the water types have different correlation between sediment and chlorophyll and correspond to coastal zones with different hydrological conditions. The experimental data verifies the predicted low sensitivity of the atmospheric correction algorithm, and it is noted that the procedure is useful in turbid water where sediment and chlorophyll concentrations are uncorrelated. I.F.

A86-40822

AUTOMATIC INTERPRETATION OF WAVE FIELDS FROM SEASAT 1 SAR RADAR DATA [INTERPRETATION AUTOMATIQUE DE CHAMPS DE VAGUES A PARTIR DES DONNEES DU RADAR SAR DE SEASAT 1]

F. CUQ (Ecole Normale Superieure, Montrouge, France) Photo Interpretation (ISSN 0031-8523), vol. 23, July-Aug. 1984, p. 1-4. In English, French, and Spanish.

Based on Seasat 1 images recorded on August 21, 1978 above the Pertuis Breton (France) narrows, sea state parameters are extracted to compute the wavelength at infinite depth and wave field characteristics, with the exception of significant wave height. Data were recorded at the beginning of ebb tide, 1 h after high spring tide with a 1.06 coefficient. The 1024-square pixel subimage, with pixels of 12.5 on one side, was preprocessed using a two-dimensional Fourier transform. A two-channel image was convolved, and parameters are quantified by a survey of mean direction, revealing six principal zones. The period, velocity, angular frequency, number of waves, and group velocity are computed for wavelengths of 100, 110, and [illegible] m. The method has application to the climatology of sea states, coast wave incidence angle analysis, and coastal drift current direction and speed measurement. Processed Seasat images are included. R.R.

A86-40851*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

AAFE RADSCAT 13.9-GHZ MEASUREMENTS AND ANALYSIS - WIND-SPEED SIGNATURE OF THE OCEAN

L. C. SCHROEDER (NASA, Langley Research Center, Hampton, VA), P. R. SCHAFFNER (Research Triangle Institute, Hampton, VA), J. L. MITCHELL (Kentron International, Inc., Hampton, VA), and W. L. JONES (Harris Corp., Melbourne, FL) IEEE Journal of Oceanic Engineering (ISSN 0364-9059), vol. OE-10, Oct. 1985, p. 346-357. refs

The Advanced Applications Flight Experiment Radiometer Scatterometer, or 'AAFE RADSCAT', was developed as a research tool for the evaluation of the use of microwave remote sensors in gathering data on wind speed at the ocean's surface. The most important function of AAFE RADSCAT was to furnish a data base of ocean normalized radar cross section (NRCS) measurements as a function of surface wind vector at 13.9 GHz. The NRCS measurements cover a wide parametric range of incidence and azimuth angles and winds. Attention is presently given to analyses of data from the 26 RADSCAT flights during which the quality of the sensors and the surface wind measurements were felt to be understood; subsets of the data base are used to model the relationship between the Ku-band radar signature and the ocean surface wind vector. O.C.

A86-40852* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

DETERMINATION OF SEA ICE MOTION USING DIGITAL SAR IMAGERY

J. C. CURLANDER, B. HOLT, and K. J. HUSSEY (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IEEE Journal of Oceanic Engineering (ISSN 0364-9059), vol. OE-10, Oct. 1985, p. 358-367. NASA-supported research. refs

Precise, densely sampled maps of ice motion have been derived from digital Seasat SAR imagery, in order to determine the small scale spatial variability of ice formation. The SAR images were processed to remove geometric distortions, and then located to an accuracy of about 100 m by means of a spacecraft orbital data/SAR characteristics algorithm, independently of attitude and ground reference point data. Ice features common to an overlapping pair of images yielded vector plots of ice motion that indicate a high degree of spatial deformation, demonstrating the potential value of spaceborne SAR data. O.C.

A86-40857

THE STATUS OF THE PASSIVE MICROWAVE SENSING OF THE WATERS LAKES, SEAS, AND OCEANS - UNDER THE VARIATION OF THEIR STATE, TEMPERATURE, AND MINERALIZATION (SALINITY): MODELS, EXPERIMENTS, EXAMPLES OF APPLICATION

A. M. SHUTKO (AN SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR) IEEE Journal of Oceanic Engineering (ISSN 0364-9059), vol. OE-10, Oct. 1985, p. 418-437. refs

A86-40858* Applied Science Associates, Inc., Apex, N.C.

THE EFFECT OF MICROWAVE BACKSCATTER UNCERTAINTY ON SATELLITE RADAR ALTIMETER ACCURACY

L. S. MILLER (Applied Science Associates, Inc., Apex, NC) and C. L. PARSONS (NASA, Wallops Flight Center, Wallops Island, VA) IEEE Journal of Oceanic Engineering (ISSN 0364-9059), vol. OE-10, Oct. 1985, p. 438-442. refs

The effect of variations in ocean surface roughness characteristics with upwind/downwind direction, reported by other investigators, is used to compute radar cross section (RCS) and to assess the errors which may arise in present and planned altimeter sensors. Based on an analysis of the rough surface impulse response, the uncertainty between attitude angle and RCS asymmetry is found to cause height errors as large as 12 cm, depending on off-nadir angles and sea state. Additionally, the previously reported data in conjunction with computed facet backscatter are found to produce RCS characteristics at large off-nadir angles which are in better agreement with experimental results than those predicted by physical optics Gaussian theory.
Author

A86-41369

WARM OUTBREAKS OF THE GULF STREAM INTO THE SARGASSO SEA

P. CORNILLON, D. EVANS (Rhode Island, University, Kingston), and W. LARGE (National Center for Atmospheric Research, Boulder, CO) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, May 15, 1986, p. 6583-6596. refs
(Contract N00014-81-C-0062)

The characteristics of warm outbreaks, large bodies of Gulf Stream water with apparent anticyclonic circulation that detach from the Gulf Stream and exist as well-defined entities in the Sargasso Sea, are discussed. A total of 18 separate warm outbreaks observed by satellite from May 1979 to June 1984 are described in terms of their location, circulation, size and orientation, time scales, horizontal displacement, vertical extent, SST differences between warm outbreak and the Sargasso Sea, and frequency of formation. The warm outbreaks are then related to the numerical predictions of 'opposite vortices' by Ikeda and Apel (1981) and to observations of anticyclonic eddies in the Sargasso Sea.
C.D.

A86-41371

HOW RADIAL ORBIT ERRORS ARE MAPPED IN ALTIMETRIC SURFACES

P. MAZZEGA (Etablissement Principal du Service Hydrographique et Oceanographique de la Marine, Brest, France) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, May 15, 1986, p. 6609-6628. Research supported by the Institut Francais de Recherche et pour l'Exploitation de la Mer. refs
(Contract CNRS-ATP-84-3253)

The correlation between sea or ice sheet surface topographies and radial orbit errors is examined in the context of space-time sampling of the domain by an orbiting altimeter. Useful properties of the radial orbit errors are derived, and it is shown that the geographical coordinates and the time are independent variables of the error mapped on the earth. Hence, the spatial structure of a given orbit error is entirely deduced from the first satellite's coverage of the earth. The next satellite passes generate what appears as a slow oscillation in time of the spatial structure of the error. Taking the restitution of the sea surface signature from altimetry into consideration, the formulation is completed to provide the full correlation function involved in oceanographic studies and the mapping function of the orbit errors in altimetric surfaces. These ideas are illustrated by applications to the Seasat repeat orbit.
C.D.

A86-43600

THE OCEAN SURFACE: WAVE BREAKING, TURBULENT MIXING AND RADIO PROBING; PROCEEDINGS OF THE SYMPOSIUM, TOHOKU UNIVERSITY, SENDAI, JAPAN, JULY 19-25, 1984

Y. TOBA, ED. (Tohoku University, Sendai, Japan) and H. MITSUYASU, ED. (Kyushu University, Fukuoka, Japan) Symposium sponsored by the Intergovernmental Oceanographic Commission, World Meteorological Organization, Ministry of Education, Science and Culture of Japan, et al. Dordrecht, D. Reidel Publishing Co., 1985, 598 p. No individual items are abstracted in this volume.

Various papers on the ocean surface are presented, covering the areas of nonlinear wave dynamics, generation of wind waves, ocean-wave forecasting models, satellite observation of the ocean, and dynamics of the oceanic mixed layer for climate study. Special emphasis is placed on wave breaking as a key process connecting these subjects. These papers provide up-to-date reviews of the state of progress in this field of research.
C.D.

A86-43741

AN ANALYTICAL MODEL FOR HF BACKSCATTERED DOPPLER SPECTRUM FOR THE OCEAN SURFACE

S. K. SRIVASTAVA and J. WALSH (Newfoundland, Memorial University, Saint John's, Canada) (IEEE and URSI, Special Session on HF Radar Remote Sensing Techniques, University of British Columbia, Vancouver, Canada, June 18-20, 1985) IEEE Journal of Oceanic Engineering (ISSN 0364-9059), vol. OE-11, April 1986, p. 293-295. Research supported by the Department of National Defence of Canada. refs

A86-43851* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

OVERVIEW OF THE SHUTTLE IMAGING RADAR-B PRELIMINARY SCIENTIFIC RESULTS

C. ELACHI, J. CIMINO (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), and M. SETTLE (NASA, Washingon, DC; ARCO Oil and Gas Co., Plano, TX) Science (ISSN 0036-8075), vol. 232, June 20, 1986, p. 1511-1516. NASA-supported research. refs

Data collected with the Shuttle Imaging Radar-B (SIR-B) on the October 5, 1985 Shuttle mission are discussed. The design and capabilities of the sensor which operates in a fixed illumination geometry and has incidence angles between 15 and 60 deg with 1 deg increments are described. Problems encountered with the SIR-B during the mission are examined. the The radar stereo imaging capability of the sensor was verified and three-dimensional images of the earth surface were obtained. The oceanography experiments provided significant data on ocean wave and internal wave patterns, oil spills, and ice zones. The geological images revealed that the sensor can evaluate penetration effect in dry soil from buried receivers and the existence of subsurface dry channels in the Egyptian desert was validated. The use of multiincidence angle imaging to classify terrain units and derive vegetation maps and the development of terrain maps are confirmed.
I.F.

A86-44012* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE 40-50 DAY OSCILLATION AND THE EL NINO/SOUTHERN OSCILLATION - A NEW PERSPECTIVE

K. M. LAU (NASA, Goddard Space Flight Center, Greenbelt, MD) and P. H. CHAN (Applied Research Corp., Landover, MD) American Meteorological Society, Bulletin (ISSN 0003-0007), vol. 67, May 1986, p. 533, 534. refs

The tropical ocean-atmosphere exhibits two prominent modes of low-frequency oscillations, i.e., the '40-50' day oscillation and the El Nino/Southern Oscillation (ENSO). The two phenomena are viewed in the same perspective from 10 years of satellite-derived out-going-longwave-radiation data. Results reveal some interesting features that may lead to new insights into the understanding of the two phenomena. Author

A86-44165

ON THE ESTIMATION OF WAVE SLOPE- AND HEIGHT-VARIANCE SPECTRA FROM SAR IMAGERY

F. M. MONALDO (Johns Hopkins University, Laurel, MD) and D. R. LYZENGA (Michigan, Environmental Research Institute, Ann Arbor) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 543-551. refs

A procedure is described for using synthetic aperture radar (SAR) imagery to estimate two-dimensional ocean wave slopeand height-variance spectra. The logic underpinning the procedure is based both on the results of the numerical simulation of SAR wave imagery and analytic descriptions of the SAR imaging process. The procedure, when applied to SAR imagery of waves acquired during the recent Shuttle Imaging Radar Mission (SIR-B), is shown to produce spectra that agree with independent measures of both the two-dimensional slopeand height-variance spectra. The implications of these results for future SAR missions aimed at measuring ocean waves are considered. Author

A86-44166

SIR-B OBSERVATIONS OF OCEAN WAVES IN THE NE ATLANTIC

G. E. KEYTE (Royal Aircraft Establishment, Farnborough, England) and J. T. MACKLIN (General Electric Co., PLC, Marconi Research Centre, Chelmsford, England) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 552-558. refs

Synthetic-aperture radar (SAR) imagery from SIR-B was obtained over a deep-water site in the NE Atlantic Ocean. Selected images were Fourier analyzed in order to compare SAR measurements of ocean waves with simultaneous data obtained from wave buoys deployed in the site. The wave heights were not large enough to be detected in the first pass over the site, but larger wave amplitudes were present in two subsequent passes that were almost orthogonal and separated by 6 h. The first of these passes showed a system of waves traveling close to the range direction, and secondary wave systems were present in some spectra. Azimuth-traveling waves were seen clearly on only one of the spectra from the second of these passes. All the spectra had the appearance expected from a linear imaging theory, and no significant discrepancies were found between the SAR and buoy measurements of the wavelengths and directions of the dominant wave systems. However, the difficulty in detection azimuth-traveling waves here may be hard to explain in terms of existing theories, but this is not a firm conclusion because large variations (factors of about 4) in spectral intensity were observed across distances as small as 20 km. This variability means that it is very difficult to determine whether SIR-B was observing the true sea state. Procedures to obtain more accurate tests of sea-imaging theories are discussed. Author

A86-44167

COMPARISON OF SIMULATED AND MEASURED SYNTHETIC APERTURE RADAR IMAGE SPECTRA WITH BUOY-DERIVED OCEAN WAVE SPECTRA DURING THE SHUTTLE IMAGING RADAR B MISSION

W. ALPERS (Bremen, Universitaet, West Germany), C. BRUENING (Max-Planck-Institut fuer Meteorologie, Hamburg, West Germany), and K. RICHTER (Deutsches Hydrographisches Institut, Hamburg, West Germany) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 559-566. refs

During the SIR-B mission over the North Sea, two successful synthetic aperture radar (SAR) data takes with simultaneous buoy measurements of ocean wave spectra have been obtained on October 6 and 8, 1984. On October 6, the SAR imaging of ocean waves was predicted as strongly nonlinear and on October 8 as almost linear. The SIR-B experiment confirmed the theoretical predictions. By applying the SAR imaging model based on velocity bunching theory the SAR image spectra are calculated from the measured ocean wave spectra. These calculated SAR image spectra are compared with the SIR-B derived SAR image spectra and it is shown that both agree quite well. This is considered as a further experimental confirmation for the velocity bunching model that has been proposed for describing SAR imaging of ocean surface waves. Author

A86-44168

SIR-B EXPERIMENTS IN JAPAN - SENSOR CALIBRATION AND OIL POLLUTION DETECTION OVER OCEAN

M. FUJITA, H. MASUKO, S. YOSHIKADO, K. OKAMOTO, H. INOMATA (Ministry of Posts and Telecommunications, Radio Research Laboratories, Koganei, Japan) et al. IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 567-574. refs

Preliminary results of the SIR-B experiments conducted in Japan are reported mainly on the sensor calibration and the oil pollution experiments. No significant result was obtained for the rice crop experiment which was carried out at the same time, mainly due to the late flight of SIR-B. The sensor calibration experiment was eventually reduced to only the evaluation of the imaging characteristics of SIR-B. However, a reasonable relation between the image count and RCS is found, and the resolution analysis by using the corner reflector images gives satisfactory results. A possible cause leading to what are rather overestimates of the resolution is pointed out to be the background clutter. A simulated oil slick area over sea was clearly detected on the SIR-B image, although the incident angle was not so appropriate for the purpose. This result demonstrates the capability of a space-borne synthetic aperture radar for effective surveillance of oil spills over high seas. Author

A86-44368* Universities Space Research Association, Huntsville, Ala.

A SATELLITE PASSIVE 37-GHZ SCATTERING-BASED METHOD FOR MEASURING OCEANIC RAIN RATES

R. W. SPENCER (Universities Space Research Association, Huntsville, AL) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 25, June 1986, p. 754-766. refs
(Contract NAS8-34767)

A combination of theory and measurement is used to develop a scattering-based method for quantitatively measuring rainfall over the ocean from Nimbus-7 Scanning Multichannel Microwave Radiometer (SMMR) 37-GHz observations. This technique takes the observed scattering effects of precipitation on 37-GHz brightness temperatures and applies it to the oceanic environment. It requires an estimate of the effective radiating temperature of the cloudy portion of the atmosphere, and a brightness temperature measurement of the cloud-free ocean surface. These two measurements bound all possible combinations of clear and cloudy conditions within a footprint in terms of bipolarized brightness temperatures. Any satellite-observed brightness temperature T(B) lower than these values is assumed to reflect scattering, which at 37 GHz is only due to precipitation-size hydrometeors. Because the technique involves linear transformation between dual polarized brightness temperature and rain rate, there are no nonlinear 'footprint filling' effects and a unique footprint-averaged rain rate results. It is shown that these SMMR-derived rain rates for five cases of convection over the Gulf of Mexico are closely related to simultaneously derived radar rain rates, having a correlation of 0.90. This technique is then applied to a massive squall line over the Gulf of Mexico, and the resulting rain rate distribution reflects features found in cloud top heights and texture inferred from GOES infrared and visible imagery. Author

A86-44370* Washington Univ., Seattle.

DIURNAL VARIATION OF OUTGOING LONGWAVE RADIATION IN THE TROPICS

D. L. HARTMANN and E. E. RECKER (Washington, University, Seattle) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 25, June 1986, p. 800-812. refs
(Contract NAS1-16462)

The diurnal harmonic in longwave emission in the tropical belt (30 deg N-30 deg S) is estimated from nine years of NOAA polar-orbiting satellite data. The results are compared successfully with Nimbus-7 ERB scanner data and with GOES-West geosynchronous satellite data. An interesting and consistent diurnal variation in longwave emission is found over the regions of intense oceanic convection, such as the ITCZ and SPCZ regions, with a peak-to-peak variation of 6-8 W/sq m and a maximum in the morning (0600-1200 LST). Histogram analysis indicates that this variation is associated with a diurnal variation in convective cloud (about 400 mb). Over regions of very intense convection, a diurnal variation of very high clouds (above 100 mb), which is out of phase with the variations at lower levels in the atmosphere, reduces the magnitude of the diurnal harmonic in longwave emission. It is interesting that histograms based on data averaged over 8-km and 250-km boxes give the same qualitative information about cloud and emission variability. Author

A86-45140

CTD AND VELOCITY SURVEYS OF SEAWARD JETS OFF NORTHERN CALIFORNIA, JULY 1981 AND 1982

P. M. KOSRO and A. HUYER (Oregon State University, Corvallis) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, June 15, 1986, p. 7680-7690. refs
(Contract NSF OCE-80-14943; NSF OCE-84-10862; NSF OCE-84-10546; N00014-80-C-0440)

The results of two mesoscale surveys conducted near Point Arena, California to determine the structure and circulation associated with tongues of cold surface water extending seaward from the coastal zone are presented. The mesoscale structure of the observed temperature, salinity, density, and current fields are described, the observed features are related to those seen in the satellite images, and the directly measured currents are related to the distributions of water properties and to estimates of the geostrophic flow. The relationship of the observed seaward jets to the southward surface current flowing along the Oregon and northern California coast in summer is discussed. C.D.

A86-45234

EXPERIMENTAL INVESTIGATION OF THREE- AND FOUR-WAVES RESONANCE INTERACTIONS OF SURFACE SEA WAVES [EKSPERIMENTAL'NYE ISSLEDOVANIIA TREKH- I CHETYREKHVOLNOVYKH REZONANSNYKH VZAIMODEISTVII POVERKHNOSTNYKH MORSKIKH VOLN]

I. I. STRIZHKIN and V. I. RALETNEV (Moskovskii Institut Inzhenerov Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR) Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana (ISSN 0002-3515), vol. 22, April 1986, p. 412-417. In Russian. refs

A86-45235

SPACE-TIME ANALYSIS OF SEA SURFACE PHOTOGRAPHS [PROSTRANSTVENNO-VREMENNOI ANALIZ FOTOIZOBRAZHENII MORSKOI POVERKHNOSTI]

V. M. BURDIUGOV, S. A. GRODSKII, V. N. KUDRIAVTSEV, and A. A. SUBBOTIN (AN USSR, Morskoi Gidrofizicheskii Institut and Institut Biologii Iuzhnykh Morei, Sevastopol, Ukrainian SSR) Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana (ISSN 0002-3515), vol. 22, April 1986, p. 418-426. In Russian. refs

Time-sequenced aerial photographs of the Black Sea in August 1982 are used to estimate the relationship between the space and time scales of sea-surface brightness variations. Bandlike structures observed on the images are interpreted as internal waves on the sea surface. B.J.

A86-45240

INVESTIGATION OF THE DYNAMICS OF MESOSCALE FRONTS ON THE BASIS OF MICROWAVE SENSING OF THE OCEAN [ISSLEDOVANIE DINAMIKI MEZOMASSHTABNYKH FRONTOV PO DANNYM DISTANTSIONNOGO ZONDIROVANIIA OKEANA V SVCH-DIAPAZONE]

A. IU. IVANOV, V. P. NEFEDEV, A. V. SMIRNOV, and V. S. ETKIN (AN SSSR, Institut Kosmicheskikh Issledovanii, Moscow, USSR) Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana (ISSN 0002-3515), vol. 22, April 1986, p. 440-447. In Russian. refs

Remote sensing data collected in the Friz Strait and adjacent regions of the Sea of Okhotsk and the Pacific Ocean in 1982-1983 provide the basis for evaluating geological conditions and wave mass dynamics. The remote sensing images are applied to the study of water and energy exchange, temperature distributions, and hydrometeorological parameters such as wind velocity. Variations in the sea surface roughness are analyzed, and the remote sensing data are compared with ship measurements. I.F.

A86-46331

SEA SURFACE AND DEPTH DETECTION IN THE WRELADS AIRBORNE DEPTH SOUNDER

B. BILLARD and P. J. WILSEN (Department of Defence, Electronics Research Laboratory, Adelaide, Australia) Applied Optics (ISSN 0003-6935), vol. 25, July 1, 1986, p. 2059-2066. Research supported by the Royal Australian Navy. refs

Algorithms are presented which have been developed for the WRELADS airborne depth sounder for the detection and location of sea surface and sea bottom reflections within the waveform of 256 consecutive 2-ns samples of received green light energy. The algorithms must be flexible to cater to the wide range of sea conditions encountered operationally in the WRELADS testing program and simple to cater to the computational intensiveness of this portion of the overall WRELADS data processing and yet have quantifiable reliability and accuracy. A concept of pulse confidence (related to SNR) is developed and shown to be related to the probability that a pulse detected as a sea bottom reflection is valid. Author

A86-46336

REMOTE SENSING OF SCATTERING COEFFICIENT FOR AIRBORNE LASER HYDROGRAPHY

B. BILLARD (Department of Defence, Electronics Research Laboratory, Adelaide, Australia) Applied Optics (ISSN 0003-6935), vol. 25, July 1, 1986, p. 2099-2108. Research supported by the Royal Australian Navy. refs

A method is proposed for using dual fields of view to allow remote sensing of the sea's optical scattering coefficient from a laser-based airborne hydrographic system. The method depends on measurement of the rate of decay of the detected volume backscatter from a pulse of laser energy directed into the ocean and is, therefore, inherently independent of system gain calibration. The method builds on previous Monto Carlo studies of multiple scattering within the ocean bulk. An appropriate choice of fields of view allows determination of the scattering coefficient over a range appropriate to hydrographic interest in coastal waters. Limited data from flights of the WRELADS laser airborne hydrographic system support the applicability of the concept. Author

A86-46479* Florida State Univ., Tallahassee.

ASSIMILATION OF SCATTEROMETER WINDS INTO SURFACE PRESSURE FIELDS USING A VARIATIONAL METHOD

J. HARLAN, JR. and J. J. OBRIEN (Florida State University, Tallahassee) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, June 20, 1986, p. 7816-7836. NASA-Navy-supported research. refs

A variational formulation was used to assimilate Seasat-A scatterometer (SASS) surface wind measurements near and during a severe storm in the North Atlantic into conventional National Meteorological Center sea level pressure fields. An estimate of the relative vorticity at every point on a grid was calculated using each of these two data sets. A solution to a modified geostrophic stream function is found subject to the constraints that (1) the relative vorticities calculated from the data agree as closely as possible with the relative vorticities from the variational solution, and that (2) the average kinetic energy is a minimum. Results are obtained which support the idea that averaged satellite data can be treated as synoptic data. Direct substitution rather than a time-weighted insertion made from SASS winds generelly resulted in more accurate pressure analyses. In addition, this relatively simple model provides surface pressure fields which agree extremely well with surface truth and the results of other investigators who required additional sources of input data into more complex models. It will be possible to obtain improved wind field maps from future scatterometer pressure fields in mid-latitudes. Author

A86-46677

APPLICATIONS OF MILLIMETER WAVE IMAGING

J. P. HOLLINGER (U.S. Navy, Naval Research Laboratory, Washington, DC) IN: Millimeter wave technology III; Proceedings of the Meeting, Arlington, VA, April 9, 10, 1985 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1985, p. 118-124. refs

The emission, absorption, and transmission of atmospheric constituents and their effects on the choice of observational frequency are briefly discussed. Then, general radiative properties of terrain and ocean surfaces are considered, including the wave effect and the influence of sea foam, oil on the sea surface, and the effects of metal objects and snow fields. Major emphasis is placed on the application of millimeter wave imaging to the all-weather location and measurement of sea ice properties. C.D.

A86-48959

REMOTE SENSING OF COASTAL DISCHARGE SITES USING SPOT-SIMULATION DATA

P. A. DAVIES and J. A. CHARLTON (Dundee, University, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, June 1986, p. 815-824. refs
(Contract SERC-GR/C/05236; SERC-GR/C/05274)

A86-48965

SATELLITE IMAGES AND THEIR USE IN THE NUMERICAL MODELLING OF COASTAL PROCESSES

E. TH. BALOPOULOS (National Centre for Marine Research, Athens, Greece), M. B. COLLINS, and A. E. JAMES (Swansea, University College, Wales) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, July 1986, p. 905-919. refs

A86-49276

SURFACE MANIFESTATIONS OF INTERNAL OCEAN WAVES OBSERVED FROM SHIPS AND THE SALYUT-6 SATELLITE [POVERKHNOSTNYE PROIAVLENIIA VNUTRENNIKH VOLN V OKEANE PO NABLIUDENIIAM S ORBITAL'NOI STANTSII 'SALIUT-6' I S KORABLIA]

A. S. KAZMIN (AN SSSR, Institut Okeanologii, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1986, p. 7-15. In Russian. refs

New data on the spatial structure of internal waves (IWs) in the Pacific between the coast of Peru and the Galapagos Islands have been derived from shipboard observations and space images. As a rule, the IWs occurred as single packets and exhibited a distinct geographic association with simultaneously observed frontal interfaces. Unlike well-known patterns of IW generation caused by tides on the continental slope, the IWs in the eastern Pacific showed no apparent correlation with the bottom relief. The presence of internal waves, normal to isobaths and to the shoreline, which experience no refraction in shallow water, was observed. I.S.

A86-49277

THE EFFECTS OF SEA WATER TEMPERATURE AND SALINITY ON THE CHARACTERISTICS OF MICROWAVE RADAR SIGNALS [VLIIANIE TEMPERATURY I SOLENOSTI MORSKOI VODY NA KHARAKTERISTIKI RADIOLOKATSIONNOGO SIGNALA SVCH-DIAPAZONA]

IU. V. TEREKHIN and V. V. PUSTOVOITENKO (AN USSR, Morskoi Gidrofizicheskii Institut, Sevastopol, Ukrainian SSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1986, p. 16-20. In Russian. refs

A 'double-scale model' of a scattering surface, developed by Wright (1968) and Bass et al. (1968, 1972) was used to study the effects of sea-water salinity and the surface temperature on the radar scattering cross section obtained from the data of satellite-borne sidelooking radar. It was found that variations of temperature from 0 to 30 C and variations of salinity from 0 to 40 percent produce no appreciable effect on the radar cross section, and thus can be neglected in interpretations of radar sounding data obtained at small (less than 20 deg) grazing angles, the temperature and salinity changes must sometimes be taken into consideration. I.S.

A86-49278

AN ANALYSIS OF MACROSCALE AND MESOSCALE FEATURES OF OCEAN SURFACE WAVE FIELDS APPEARING ON COSMOS-1500 RADAR IMAGES [ANALIZ MAKRO- I MEZOMASSHTABNYKH OSOBENNOSTEI POLIA VOLNENIIA, PROIAVLIAIUSHCHIKHSIA NA RADIOLOKATSIONNYKH IZOBRAZHENIIAKH S ISZ 'KOSMOS-1500']

L. M. MITNIK (AN SSSR, Tikhookeanskii Okeanologicheskii Institut, Vladivostok, USSR), G. I. DESIATOVA (Dal'nevostochnyi Regional'nyi Tsentr Priema i Obrabotki Sputnikovykh Dannykh, Khabarovsk, USSR), and V. V. KOVBASIUK (Kamchatskoe Territorial'noe Upravlenie po Gidrometeorologii i Kontroliu Prirodnoi Sredy, Petropavlovsk-Kamchatski, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1986, p. 21-31. In Russian. refs

Images of the northwestern Pacific in the area of the Sea of Okhotsk, obtained by the sidelooking radar aboard Cosmos-1500 in December 1983 and January 1984, are presented. Interpretation of radar image brightness relies on satellite images taken in the visible and the IR spectral ranges, synoptic maps, in situ measurements of wind directions and velocities, and simulated data. Cloud banks, convective cells, and atmospheric fronts appear on the radar images because these formations modulate the speed and direction of the wave-driving wind, and thus the roughness of the sea surface and the magnitude of the specific area of inverse scatter. I.S.

A86-49281

SIMULTANEOUS OPTICAL AND CONTACT STUDIES OF SPATIAL-SPECTRAL CHARACTERISTICS OF SEA WAVES [SINKHRONNYE OPTICHESKIE I KONTAKTNYE ISSLEDOVANIIA PROSTRANSTVENNO-SPEKTRAL'NYKH KHARAKTERISTIK MORSKOGO VOLNENIIA]

V. A. GRUSHIN, IU. A. ILIN, A. A. LAZAREV, E. A. LUPIAN, V. A. MALINNIKOV (AN SSSR, Institut Kosmicheskikh Issledovanii; Moskovskii Institut Inzhenerov Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR) et al. Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1986, p. 57-67. In Russian. refs

The results of simultaneous contact measurements (using a parallel-wire wavemeter) and optical measurements (with airborne photoequipment) of the spatial-spectral characteristics of surface waves and of a stratified near-surface layer of the Caspian Sea are presented. Digital procedures are described for recovering wave-height spectra by the use of two-dimensional spectra of film blackening. Good qualitative and quantitative agreement is shown for frequency spectra measured in situ and one-dimensional spectra recovered from optical observations. I.S.

A86-49283

LEVEL ANALYSIS AND DIGITAL PROCESSING OF SIGNALS RECEIVED FROM THE COSMOS-1500 SIDELOOKING RADAR [ANALIZ UROVNEI I TSIFROVAIA OBRABOTKA RADIOLOKATSIONNYKH SIGNALOV, PRINIMAEMYKH S RADIOLOKATORA BOKOVOGO OBZORA ISZ 'KOSMOS-1500']

B. A. BAUM, S. K. VIATKIN, A. G. GRIBUNIN, V. V. KIRILLOV, and I. M. PEREPELITSKII (Dal'nevostochnyi Regional'nyi Tsentr Priema, Obrabotki i Rasprostraneniia Kosmicheskoi Informatsii, Khabarovsk, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1986, p. 92-95. In Russian. refs

A procedure for the digital processing of sea-surface radar images obtained by the sidelooking radar aboard the Cosmos-1500 satellite is described. The procedure is conducted in two steps: (1) automatic data processing for obtaining visual images and (2) amplification of the image contrasts, using an algorithm which permits variations in the radar-image dynamic range. A statistical correlation has been established between the radar signal levels and surface-wind velocities measured by ship instruments. I.S.

A86-49290

SYNOPTIC VARIABILITY IN THE OCEAN [SINOPTICHESKAIA IZMENCHIVOST' V OKEANE]

V. G. KORT, ED. and E. G. MOROZOV, ED. Moscow, Izdatel'stvo Radio i Sviaz' (Okeanologicheskie Issledovaniia, No. 38). 1985, 68 p. In Russian. No individual items are abstracted in this volume.

Papers are presented on such topics as the formation of the total solar radiation regime in the POLYMODE area; three-dimensional general water circulation in Mare Tirreno; the spatial spectrum of semidiurnal internal waves in the Northwest Pacific. Consideration is also given to a numerical study of seasonal climatic circulation of water in the Mozambique Channel area, solar and atmospheric radiation in the subtropical zone of the North Atlantic, and deep waters of the Atlantic Ocean. B.J.

A86-49685* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

WIND-DRIVEN UPWELLING IN THE VICINITY OF CAPE FINISTERRE, SPAIN

C. R. MCLAIN (NASA, Goddard Space Flight Center, Greenbelt, MD), S.-Y. CHAO (Maryland, University, Cambridge), L. P. ATKINSON (Old Dominion University, Norfolk, VA), J. O. BLANTON (Skidaway Institute of Oceanography, Savannah, GA), and F. DE CASTILLEJO (Instituto Espanol de Oceanografia, Malaga, Spain) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, July 15, 1986, p. 8470-8486. NASA-supported research. refs

Observations and numerical simulations of the evolution of upswelling and the resultant coastal circulation in response to two wind events occurring along the Galician coast of Spain during the April 18-26, 1982 period are presented. In situ measurements include shipboard determinations of hydrographic and biological parameters, and wind stress estimates obtained from the ship winds and from surface pressure charts. Sea surface temperature information was derived from NOAA 7 satellite images, and pigment concentration information was acquired from the Nimbus 7 coastal zone color scanner. The indication from the simulations that the greatest upswelling will occur either at Cape Finisterre or along the northern coast was confirmed by observations, and it is suggested that wave disturbances propagate northward along the coast at a speed of 120-160 km/day, and that organic material formed north of Cape Finisterre is advected out to sea northwest of the cape. R.R.

A86-49687

A NUMERICAL STUDY OF THE EFFECTS OF ANOMALOUS NORTH ATLANTIC ATMOSPHERIC CONDITIONS ON THE INFRARED MEASUREMENT OF SEA SURFACE TEMPERATURE FROM SPACE

P. J. MINNETT Journal of Geophysical Research (ISSN 0148-0227), vol. 91, July 15, 1986, p. 8509-8521. refs

(Contract CEC-STI-022-J-C)

Based on 100 marine radiosonde profiles over the NE Atlantic Ocean obtained over a seven-year period for the month of July, a line-by-line radiation transfer model is used to simulate the brightness temperature measured in the atmospheric window between 10 and 13 microns by the high resolution radiometer AVHRR/2 on the NOAA 7 satellite. It is demonstrated that the consequences of humidity anomalies are greater if they occur at pressures of less than 800 mbar, while temperature anomalies have greater effect if they occur in the lower troposphere. Sea surface temperature (SST) retrieval coefficients, optimized for the July conditions, were found to be acccurate, with mean errors of several tenths of a kelvin when previous nonoptimized coefficients were applied to the July conditions. Extremely anomalous atmospheric conditions also yielded mean errors in SST of a few tenths of a kelvin using the optimized coefficients. R.R.

A86-49765

METHODOLOGICAL ASPECTS OF VISUAL OBSERVATIONS OF THE OCEAN WATER COLOR [METODICHESKIE ASPEKTY VIZUAL'NYKH NABLIUDENII TSVETA OKEANSKIKH VOD]

V. P. LEVENTUEV and S. I. POTAICHUK (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Morskogo Rybnogo Khoziaistva i Okeanografii, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1986, p. 17-20. In Russian. refs

The colors of the various areas of the world ocean perceived visually by cosmonauts aboard Salyut-7 were correlated with the color samples of the AC-1000 color atlas and compared with the ocean surface colors measured instrumentally on board ships. For typical ocean scenes observed from space (water background and 'green heterogeneities') there was a tendency to report colors, permissible by the AC-1000 atlas, which were closest to the colors measured experimentally. It is suggested that, after a period of adaptation, the human eye is capable of color discrimination, i.e., of detecting signals like ocean water color in a very noisy environment generated by atmosphere-scattered radiation. I.S.

A86-49770

ASPECTS OF THE USE OF SATELLITE IR DATA IN STUDIES OF WATER AREAS UNDER CLOUD COVER [OSOBENNOSTI ISPOL'ZOVANIIA SPUTNIKOVOI INFORMATSII IK-DIAPAZONA DLIA IZUCHENIIA AKVATORII PRI OBLACHNYKH SITUATSIIAKH]

I. A. BYCHKOVA, S. V. VIKTOROV, and V. G. SMIRNOV (Gosudarstvennyi Okeanograficheskii Institut, Leningrad, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1986, p. 60-66. In Russian. refs

The approach taken in a study of water surface temperatures of periodically overcast water bodies with the use of information obtained from satellite IR data is described. The spatial coherence method of Coakley and Bretherton (1982) was used, after modifying the algorithm by taking into account specific features of a semienclosed water body, such as Baltic Sea. The method was applied to study the upwelling off the southern shore of the Gulf of Finland. After correcting for cloud effects and georeferencing, the correlation coefficient for the results obtained from the satellite IR data and from the data obtained by ship instruments was about 0.95. I.S.

A86-50235

INVENTORY AND ENVIRONMENTAL MANAGEMENT IN THE TROPICAL ZONE TWO EXAMPLES FROM NEW CALEDONIA [INVENTAIRE ET AMENAGEMENT DU MILIEU EN ZONE TROPICALE - DEUX EXEMPLES EN NOUVELLE CALEDONIE]

L. LOUBERSAC (Institut Francais de Recherche pour l'Exploitation de la Mer, Brest, France) Metropolis (ISSN 0224-1250), no. 70-71, 4th Quarter, 1985, p. 68-75. In French.

The results of two simulations of SPOT multispectral images of the lagoon on the coast of New Caledonia are discussed. The area simulated is a coastal lagoon offshore from a mangrove swamp, with a coral reef situated 40 km off the coast. The 23,000 sq km lagoon is being considered for development as an aquaculture zone and the adjacent swamp for fish and shrimp processing and tourism. Previous experience in other countries has shown that no more than 20 percent of a mangrove swamp can be developed without adversely affecting the entire swamp. SPOT multispectral images of the two study areas (Teremba and Tetembia) were simulated to evaluate the potential for using the images to quantify the available fish and shrimp tonnage in the lagoon, the extent of mangrove swamp development, and to generate marine charts of the reef. Sample simulated images are provided and analyzed to illustrate the techniques available for using the SPOT imagery to achieve the remote sensing goals of the region. M.S.K.

A86-50272

MARINE APPLICATIONS FOR SATELLITE-DERIVED OCEAN COLOR IMAGERY

D. K. CLARK, H. W. YATES, and J. W. SHERMAN, III (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) Sea Technology (ISSN 0093-3651), Nov. 1985, 6 p.

The Coastal Zone Color Scanner (CZCS) on Nimbus 7, the CZCS data products developed by NOAA and NASA, and some typical commercial and scientific applications are reviewed. Topics examined include the CZCS channels (four visible channels, one NIR channel for land/water discrimination, and one thermal-IR channel for simultaneous surface-temperature estimation), techniques for subtracting atmospheric effects, the discovery (using CZCS images) that some open-sea areas have small but significant concentrations of chlorophyll and phaeopigments, the use of these pigments as natural tracers for studying ocean-current structures, maps developed from CZCS data for use by the fisheries industry, and the potential value of combining Seasat-type altimeter data with CZCS-type color images. Also included is a statement by the NOAA Administrator regarding the possible development of an operational Ocean Color Imager (OCI) to succeed CZCS. It is argued that a private-government partnership such as that created for Landsat should build OCI and develop and sell data products to customers in the petroleum, marine mining, fishing, and shipping industries on a commercial basis. T.K.

N86-28492# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.

SEA ICE PARAMETER RETRIEVAL FROM SAR DATA

H. SKRIVER and P. GUDMANDSEN *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data p 21-28 Dec. 1985

Avail: NTIS HC A06/MF A01

A pixel-by-pixel classification scheme for sea ice type determination, and a spatial segmentation scheme for studies of sea ice dynamics were investigated. Before these schemes may be applied, the inherent speckle must be reduced, and noncoherent averaging and adaptive filtering (Frost and Lee filters) were applied. The Lee filter seems to give the best results. The performance of the classification method is surprisingly good, with mean classification accuracies of 80%. Three segmentation algorithms were investigated: pyramid segmentation, edge-based segmentation, and region growing, with the second scheme considered to be the best. ESA

N86-28603# Defence Research Information Centre, Orpington (England).

ON THE RECOGNITION OF OCEANIC MOTION IN SATELLITE INFRARED AND RADAR ALTIMETER DATA

P. G. HARDTKE Oct. 1985 18 p Transl. into ENGLISH of Z. fuer Flugwiss. u. Weltraumforsch., v. 96, no. 5, 1984 p 359-364 (DRIC-T-7597; BR97665; ETN-86-97135; AD-B098642L) Avail: Issuing Activity

Data from NOAA 6 and 7 showing variation of sea surface temperature in the North Atlantic are presented. These, together with radar altimeter measurements, are used to determine ocean surface currents. ESA

N86-28604# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.

MEASUREMENTS OF INTERNAL WAVES IN THE STRAIT OF GIBRALTAR USING A SHORE-BASED RADAR Final Report

P. E. LAVIOLETTE, T. H. KINDER, and D. W. GREEN, III Jan. 1986 15 p

(AD-A165715; NORDA-118) Avail: NTIS HC A02/MF A01 CSCL 17I

During the period 22 to 24 October 1983, a feasibility study was made on the use of standard shore radars to monitor the temporal and spatial distribution of internal waves. A radar (150 m elevation) situated at Gibraltar was used to monitor the surface manifestations of internal waves in the Strait of Gibraltar during three semidiurnal tidal periods. The eastward progression of internal waves within an arc approximately 19 km from the radar was observed. These observations fill a gap in the evolution of the surface signatures of internal waves between the small-scale view of ship radars and the large-scale view afforded by satellites and the Space Shuttle. Author (GRA)

N86-29443# Delaware Univ., Lewes.

OBJECTIVES OF THE TOGA CONFERENCE

F. WEBSTER *In* WMO International Conference on the TOGA Scientific Program 4 p Sep. 1985

Avail: NTIS MF A01; print copy available at WMO, Geneva

The aims of the Tropical Ocean Global Atmosphere project are to assess knowledge of the interannual variability of the tropical ocean and the global atmosphere and form the scientific basis for a research program. Program objectives are: to determine to what extent the time-dependent behavior of the tropical ocean and global atmosphere system is predictable on time scales of months to years and to understand the mechanism of this behavior; to study the feasibility of modeling the coupled ocean-atmosphere system for predicting its variations on time scales of months to years; and to provide the scientific background for designing an observing and data transmission system for operational prediction if this capability is demonstrated by coupled ocean-atmosphere models. ESA

N86-29447# Hawaii Univ., Honolulu. Dept. of Oceanography.

WATER DISPLACEMENTS DURING 1982-83 AND THE GENESIS OF EL NINO AND THE SOUTHERN OSCILLATION

K. WYRTKI *In* WMO International Conference on the TOGA Scientific Program 10 p Sep. 1985

Avail: NTIS MF A01; print copy available at WMO, Geneva

Sea level response during 1982-83 to the changing wind system is summarized. Water mass displacements during the 1982-83 El Nino are outlined. The genesis of El Nino and the Southern Oscillation is discussed. For the Tropical Ocean Global Atmosphere (TOGA) program, it is argued that in view of the importance of ocean heat storage for the analysis and understanding of climatic cycles, a complete documentation and continuous monitoring of the heat storage field in the ocean is an indispensable prerequisite for research in TOGA. The heat storage field can be best documented by a program of systematic XBT sections from ships of opportunity, supplemented by drifting thermistor chains and by a network of sea level gages. Data from this network should be available in real time so that monthly maps of ocean heat storage can be compiled and made available for analysis. ESA

N86-29450# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.

OBSERVATIONAL STRATEGY FOR TOGA PACIFIC

B. A. TAFT *In* WMO International Conference on the TOGA Scientific Program 11 p Sep. 1985 Sponsored by NOAA Equatorial Pacific Ocean Climate Studies Program
Avail: NTIS MF A01; print copy available at WMO, Geneva

The oceanographic program needed to describe large scale, low frequency variations of key variables for the entire tropical Pacific over a 10yr period is outlined. Measurement of processes which modify the heat content of the upper ocean; ocean model verification; and assimilation of data into predictive models are considered. Use of merchant ships, and moored and drifting thermistor chains to measure the thermal field is suggested. Moored equatorial current measures and surface current measures with drifters are required to study circulation. Sea level can be monitored by existing means. ESA

N86-29454# Laboratoire d'Oceanographie Physique, Paris (France).

OBSERVATIONAL STRATEGY FOR TOGA IN THE TROPICAL INDIAN OCEAN

M. FIEUX *In* WMO International Conference on the TOGA Scientific Program 8 p Sep. 1985
Avail: NTIS MF A01; print copy available at WMO, Geneva

An observational program to study the processes that control sea surface temperature changes and upper ocean heat content on intraseasonal, annual, and interannual time scales and, in particular, to determine the relative importance of advection, upwelling, surface fluxes, and heat storage is proposed for the Indian Ocean. The program includes XBT observations, drifting buoys, direct sea level measurements, satellite data collection and analysis, and a voluntary observing ship meteorological program. ESA

N86-29459# Far Seas Fisheries Research Lab., Shimizu (Japan). Div. of Oceanography and Southern Ocean Resources.

EFFECT OF EL NINO ON FISH MIGRATION AND YIELD IN THE WESTERN PACIFIC OCEAN

H. YAMANAKA *In* WMO International Conference on the TOGA Scientific Program 7 p Sep. 1985
Avail: NTIS MF A01; print copy available at WMO, Geneva

The abnormally cold water temperatures in the western Pacific Ocean caused by the 1982 El Nino event are shown. The relationship between the occurrence of El Nino and changes in the distribution and migration of the Pacific bluefin tuna is discussed. The relationship between El Nino and fluctuations in stocks of the Japanese sardine is considered. Abnormal migration and distribution of fishes and marine mammals around Japan during 1983-84 are analyzed. ESA

N86-29460# Duke Univ. Beaufort, N.C. Marine Lab.

PLANKTON PRODUCTION DURING EL NINO

F. P. CHAVEZ and R. T. BARBER *In* WMO International Conference on the TOGA Scientific Program 9 p Sep. 1985
(Contract NSF OCE-81-10702)
Avail: NTIS MF A01; print copy available at WMO, Geneva

A decrease in primary plankton productivity of 1 gigaton C during the 300-day duration of the 1982-83 El Nino is estimated. The fraction of this anomaly which can be attributed to a decrease in new production is 0.6 gC, but this new production anomaly is approximately equivalent to a predicted degassing anomaly of 0.57 gC. Models which consider degassing from equatorial upwelling as an important contributor to atmospheric carbon dioxide levels should also consider the effects of upwelling on new primary production. ESA

N86-29463# Delaware Univ., Lewes.

THE OVERALL PLAN: A SCIENTIFIC STRATEGY

F. WEBSTER *In* WMO International Conference on the TOGA Scientific Program 5 p Sep. 1985
Avail: NTIS MF A01; print copy available at WMO, Geneva

The aims of the Tropical Ocean Global Atmosphere project are to assess knowledge of the interannual variability of the tropical ocean and the global atmosphere. Program objectives are: to determine to what extent the time-dependent behavior of the tropical ocean and global atmosphere system is predictable on time scales of months to years and to understand the mechanism of this behavior; to study the feasibility of modeling the coupled ocean-atmosphere system for predicting its variations on time scales of months to years; and to provide the scientific background for designing an observing and data transmission system for operational prediction if this capability is demonstrated by coupled ocean-atmosphere models. ESA

N86-29468# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

OBJECTIVE ANALYSIS OF TROPICAL CYCLONE INTENSITY, STRENGTH, AND SIZE USING ROUTINE AIRCRAFT RECONNAISSANCE DATA M.S. Thesis

C. B. STANFIELD May 1986 126 p
(AD-A166417; AFIT/CI/NR-86-28T) Avail: NTIS HC A07/MF A01 CSCL 04B

The feasibility of objectively analyzing routine aircraft reconnaissance data for the purpose of quantifying tropical cyclone intensity, strength, and size is examined. A computer program is developed which may be used in near real time or after the fact to evaluate localized pressure/wind relationships in the tropical cyclone environment. This program compensates for the system motion and the relative position of the point of observation relative to the vortex center location at flight level and at the surface (thus accounting for the vertical tilt of the center). A representative set of data is obtained over a 13 month period for the entire spectrum of storms from tropical depression to super typhoon. These data are used to try to establish empirical pressure/wind relationships and a means of determining effective storm size. It is shown that a program of this nature may be used with gradient wind and pressure gradient relationships to evaluate intensity and strength and to define storm size, provided adequate data are available at sufficient distances from the center. Author (GRA)

N86-29474# World Climate Programme, Geneva (Switzerland).

REPORT OF THE THIRD SESSION OF THE JSC/CCCO WORKING GROUP ON SATELLITE OBSERVING SYSTEMS FOR CLIMATE RESEARCH

Oct. 1985 34 p Session held in Madison, Wisc., 29 Apr. - 2 May 1985
(WCP-105; ETN-86-97071) Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

Satellite data access; temperature and moisture soundings; geostationary satellite wind vectors; cloud climatology; radiation budget climatology; precipitation climatology; sea surface temperature; global winds; surface wind and wind stress; ocean surface topography and geostrophic component of ocean circulation; sea ice; land surface climatology; air-sea interface fluxes; distribution of chlorophyll and small flux patterns; aerosols; and the global positioning system were discussed. ESA

N86-29475# World Climate Programme, Geneva (Switzerland).

REPORT OF THE THIRD SESSION OF THE JSC/CCCO TOGA SCIENTIFIC STEERING GROUP

Nov. 1985 80 p Session held in La Jolla, Calif., 22-26 Apr. 1985
(WCP-107; ETN-86-97073) Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

Implementation of observational and data processing activities for the Tropical Oceans and Global Atmosphere (TOGA) program was reviewed. Tropical sea-level; ocean subsurface data; ocean surface circulation; ocean-atmosphere interface fluxes; sea surface temperature; surface wind/wind stress; precipitation; analyses of atmospheric meteorological parameters for TOGA; ocean modeling; use of real-time products in tropical ocean modeling and dissemination of predictions based on these; TOGA real-time monitoring strategy; and satellite observing systems for TOGA were discussed. ESA

N86-29483# National Weather Service, Honolulu, Hawaii.
TROPICAL CYCLONES, 1984, CENTRAL NORTH PACIFIC
W. AU, A. CHUN, A. INOUYE, L. IWAI, and H. ROSENDAL Mar. 1986 31 p
(PB86-183951; NOAA-TM-NWSTM-PR-30) Avail: NTIS HC A03/MF A01 CSCL 04B

Tropical storms in the Central North Pacific Ocean for 1984 are described and classified. GRA

N86-30297# Scripps Institution of Oceanography, La Jolla, Calif.
THE MAGNETIC EFFECTS OF SHALLOW WATER INTERNAL SOLITONS
A. D. CHAVE Mar. 1986 52 p
(Contract N00014-85-C-0104)
(AD-A165852; SIO-REF-86-7) Avail: NTIS HC A04/MF A01 CSCL 08C

Since internal waves are a common feature of the oceans, there has been some interest in computing their electromagnetic effects in order to assess their role in the oceanic electromagnetic environment. This report extends previous analyses to cover the electromagnetic effects of coastal internal wave packets. While no observations of the electromagnetic fields produced by them have been reported, the large amplitude of shallow water internal waves is expected to induce substantial electromagnetic anomalies. The report is organized into five sections. The next part contains a review of oceanographic observations of internal wave packets from both surface ships and satellite imagery. Section 3 outlines the hydrodynamic theory for nonlinear internal waves. Section 4 contains a derivation of expressions for the electromagnetic fields produced by an isolated internal solution both at the seafloor and above the sea surface. The last part of the report contains a discussion of the theoretical results, including a detailed look at the predicted magnetic field using measured parameters from three well-documented occurrences of internal wave packets. GRA

N86-30728# Aerojet Electrosystems Co., Azusa, Calif.
DESIGN, DEVELOPMENT AND INTEGRATE/INSTALL AN AIRBORNE REMOTE INSTRUMENTATION SYSTEM (AIREYE) Final Report
J. J. BOMMARITO and L. E. SAYLOR Aug. 1985 79 p
(Contract DTCG23-80-C-20012)
(AD-A166755; REPT-7921; USCG-D-27-85) Avail: NTIS HC A05/MF A01 CSCL 01C

A prototype airborne remote instrument system, AIREYE, was developed for the U.S. Coast Guard by Aerojet ElectroSystems Company. This multisensor system permits real-time day/night, all weather detection, mapping and documentation of vessels and pollution at sea. The system was installed aboard a coast Guard Hu-25A Falcon fanjet aircraft and flight tested off the California coast. Surveillance data were obtained from natural oil seeps, known optical and radar targets, routine shipping and targets of opportunity. The AIREYE system consists of a sidelooking radar, infrared/ultraviolet line scanner, active gated television systems, aerial reconnaissance camera and a processor/display recording subsystem with real-time digital image enhancement capability. The system reliably detected and mapped oil seeps and vessel locations for environmental conditions ranging from dense undercast to clear, windspeeds from 0 to greater than 25 knots and from daytime to total darkness. The ability to read a vessel's name and determine deck activity in total darkness was demonstrated. The AIREYE real-time digital enhancement provided detection, recognition and identification of targets of interest when not otherwise possible with unenhanced imagery. Test results demonstrated that the AIREYE system will provide greatly enhanced capability in the U.S. Coast Guard missions of Marine Environmental Protection (MEP), Enforcement of Laws and Treaties and Search and Rescue. Author (GRA)

N86-31063# Battelle Columbus Labs., Ohio.
GAS-ENGINE HEAT PUMP TEST PROCEDURES Topical Report, Oct. 1985 - Feb. 1986
S. G. TALBERT and A. L. RUTZ Apr. 1986 67 p
(Contract GRI-5084-242-1118)
(PB86-201662; GRI-86/0083) Avail: NTIS HC A04/MF A01 CSCL 13A

The purpose is to establish standardized procedures for testing gas engine-driven heat pumps,and to define the various engine heat pump performance factors. The recommended test methods outlined should enable Gas Research Institute to better monitor the several research projects now underway to develop gas engine heat pumps for residential and light commercial use. Altogether, 17 performance test points are described which will be sufficient to describe the heating and cooling performance of a variable speed heat pump over its expected range of outdoor temperatures. The tests include 11 steady-state tests, two part-load tests one defrost test, one auxiliary heater test, and two domestic water heating tests. Equations and procedures also are outlined so that the various heat pump performance factors can be calculated, as well as its expected seasonal and annual performance. GRA

N86-31090# Bremen Univ., (West Germany).
OCEANOGRAPHY
W. ALPERS, K. RICHTER (Deutsches Hydrographisches Inst., Hamburg (West Germany), and P. LOMBARDINI (Consiglio Nazionale delle Ricerche, Turin, Italy) *In* DFVLR The X-SAR Science Plan p 97-110 Nov. 1985
Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 32

Radar imaging of ocean surface phenomena at three different radar frequencies (L, C, and X-band) different polarizations (VV, HH and VH, HV) and different incidence angles by the X-SAR radar is discussed. Objectives of the X-SAR/SIR-C mission include studies of the short wave-current interaction as a function of (Bragg) wave number; the SAR imaging mechanism of long surface waves as a function of radar frequency, polarization, and incidence angle; the excitation threshold of short (Bragg) waves by the wind as a function of wave number and air/sea temperature difference; the damping of short (Bragg) waves by surface films as a function of a wave number, and film material for studying the applicability of spaceborne SARs for oil pollution surveillance; and the distribution of temporal variations of internal waves, eddies, fronts, and bores in the Mediterranean. ESA

N86-31091# Deutsches Hydrographisches Inst., Hamburg (West Germany).
ICE AND SNOW
K. STRUEBING *In* DFVLR The X-SAR Science Plan p 111-131 Nov. 1985
Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 32

Ice and snow observation by the X-SAR/SIR-C mission is outlined. Targets include sea ice and icebergs, ice sheets, ice shelves, glaciers, and snow cover. Parameters to be studied include snow line; edges and boundaries; ice concentration (total and partial); stage of development (ice type, thickness); form (floe size); openings (fractures, leads, polynyas); surface roughness (ridges, rubble fields, rafted ice); and stage of melting (puddles, melt ponds). Test sites, seasonal constraints, technical requirements, and ground truth and airborne campaigns are indicated. ESA

N86-31169# Ohio State Univ., Columbus. Dept. of Geodetic Science and Surveying.

DETAILED GRAVITY ANOMALIES AND SEA SURFACE HEIGHTS DERIVED FROM GEOS-3/SEASAT ALTIMETER DATA

R. H. RAPP Aug. 1985 134 p
(Contract F19628-82-K-0022)
(AD-A166593; OSU/DGSS-365; AFGL-TR-85-0191; SR-9) Avail: NTIS HC A07/MF A01 CSCL 08E

Gravity anomalies and sea surface heights have been computed on a 0.125 deg grid in the ocean areas from a combined Geos-3/Seasat altimeter data set. The basic procedure used least squares collocation estimation where model covariance models were tailored to individual areas through altimeter residual variance scaling. Preliminary tests led to production prediction procedures using a reference model defined by a set of potential coefficients complete to degree 180. Comparisons of the predicted anomalies with ship derived values showed agreements varying from + or - 9 to + or - 30 mgals. No corrections to the altimeter implied sea surface heights were made for sea surface topography effects. The maximum anomaly predicted was 396 mgals near Hawaii and the most negative anomaly was -361 mgals over the Puerto Rican Trench. The 0.125 data set has been used to display the results using color plots, contour maps, and perspective views. The gridded data was used to compute 1 deg x 1 deg and 0.5 x 0.5 deg mean values. 1 deg mean anomalies were compared to terrestrial data where a difference of f + or - 7 mgals was found in comparing 10139 values. GRA

N86-31201# Army Engineer District, Los Angeles, Calif. Coastal Resources Branch.

COAST OF CALIFORNIA STORM AND TIDAL WAVES STUDY. SHORELINE MOVEMENT DATA REPORT: PORTUGUESE POINT TO MEXICAN BORDER (1852-1982)

P. F. MAY and B. M. BALDWIN Dec. 1985 172 p
(AD-A166749; CCSTWS-85-10) Avail: NTIS HC A08/MF A01 CSCL 08F

This report describes the results of a cooperative study of shoreline movement conducted as part of the Coast of California Storm and Tidal Waves Study (CCSTWS). The study area comprised the Pacific Ocean coast from Portuguese Point. CA, (Near Los Angeles) south to the United States/Mexico Border, a distance of approximately 125 miles. Changes in shoreline position ranging from as early as 1852 or as late as 1959, up to 1982, are analyzed using survey data from NOAA's National Ocean Service (NOS) and its predecessor, the U.S. Coast and Geodetic Survey. A series of shoreline movement maps for this coastal reach produced by NOS is intended to accompany this report. This report provides a basic data set for use in management and engineering decisions related to the coastal zone. It is designed primarily to describe and partially quantify shoreline movement maps that accompany it. Average yearly land area and shoreline movement rates of change were calculated for each minute of longitude for the area from Portuguese Point south to Anaheim Bay (east-west-trending shoreline), and for each minute of latitude from Anaheim Bay to the U.S./Mexico border (north-south trending shoreline). The sole purpose of this report is to describe and quantify historic shoreline movement. No attempts were made to identify or even speculate on the reasons for these movements. GRA

N86-31202# Army Engineer District, Los Angeles, Calif. Coastal Resources Branch.

COAST OF CALIFORNIA STORM AND TIDAL WAVES STUDY: SOUTHERN CALIFORNIA COASTAL PHOTOGRAPHY AND BEACH PROFILE INDEX

Feb. 1986 140 p
(AD-A166780; CCSTWS-86-2) Avail: NTIS HC A07/MF A01 CSCL 08F

The purpose of this report is to compile an inventory of the aerial photography, ground photos and beach profile data long the Coast of California that are available in the U.S. Army Corps of Engineers, Los Angeles District (LAD; also includes other Federal, State, and local governmental agencies). These photographs and beach profiles were compiled to document dimensions and beach characteristics, historic shoreline changes, effects of storms and structures on the beach, and any significant beach and inlet changes. The information described in this report is available for use and inspection by Government agencies, educational institutions, coastal engineers and other coastal interest groups. GRA

N86-31205# Naval Postgraduate School, Monterey, Calif.

OCEANOGRAPHIC ANALYSIS OF SUN GLINT IMAGES TAKEN ON SPACE SHUTTLE MISSION STS 41-G M.S. Thesis

M. G. FISCHER Mar. 1986 42 p
(AD-A167142) Avail: NTIS HC A03/MF A01 CSCL 14E

A series of four sun glint images taken by the crew of the space shuttle Challenger, mission STS 41-G, on 8 October 1984 were analyzed and compared to NOAA-7 AVHRR infrared images and to bathythermographs of the same area. Evidence of the Almaria Front, a persistant oceanographic feature east of the Alboran Basin, was found on all three data sets, and the efficacy of using sun glint images for the location of acoustically important oceanographic features was supported. A practical use of sun glint photographs taken from low earth orbit was demonstrated and the investigation of its use to help in the employment of acoustic sensors is further justified by this work. Author (GRA)

N86-31942*# Oklahoma Univ., Norman. Cooperative Inst. for Mesoscale Meteorolog. Study.

DEVELOPMENT OF A VARIATIONAL SEASAT DATA ANALYSIS TECHNIQUE Final Report

Y. K. SASAKI, L. P. CHANG, and J. S. GOERSS (Naval Environmental Prediction Research Facility, Monterey, Calif.) Apr. 1986 50 p
(Contract NAG5-289)
(NASA-CR-177175; NAS 1.26:177175) Avail: NTIS HC A03/MF A01 CSCL 05B

Oceans are data-sparse areas in terms of conventional weather observations. The surface pressure field obtained solely by analyzing the conventional weather data is not expected to possess high accuracy. On the other hand, in entering asynoptic data such as satellite-derived temperature soundings into an atmospheric prediction system, an improved surface analysis is crucial for obtaining more accurate weather predictions because the mass distribution of the entire atmosphere will be better represented in the system as a result of the more accurate surface pressure field. In order to obtain improved surface pressure analyses over the oceans, a variational adjustment technique was developed to help blend the densely distributed surface wind data derived from the SEASAT-A radar observations into the sparsely distributed conventional pressure data. A simple marine boundary layer scheme employed in the adjustment technique was discussed. In addition, a few aspects of the current technique were determined by numerical experiments. Author

N86-31965# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.

NORDA ARCTIC DATA COLLECTION, PROCESSING AND INTERPRETATION CAPABILITIES Final Report

D. T. EPPLER and J. D. HAWKINS Sep. 1985 26 p
(AD-A167797; NORDA-129) Avail: NTIS HC A03/MF A01 CSCL 08L

The Special Sensor Microwave/Imager (SSM/I) will provide the Navy with the global capability to measure sea ice, wind speed, water vapor, rain rate, and several other atmospheric parameters. The sea ice retrievals will go a long way toward filling a present gap in analysis data sets. Thus, proper validation of this sensor's abilities is required if the full potential is to be achieved. Naval Ocean Research and Development Activity (NORDA) personnel have access to a number of ground, aircraft, and spaceborne instruments that can contribute to SSM/I sea ice validation efforts. Ice camps, the K-band Radiometric Mapping System (KRMS), and satellite visible and infrared data can all provide a piece of the puzzle when addressing the issue of algorithm performance. It is essential to include ground, air, and spaceborne resources to tackle the task of validating the sea ice information retrieved from SSM/I data. Not only must we cover large geographic regions synoptically, but we must also be able to discern smaller irregularities found within the SSM/I cell footprints. Only then can we push algorithms to their required limits. GRA

N86-31975# Rome Univ. (Italy). Dipt. di Fisica.

THE RESULTS OF HYDROLOGICAL MEASUREMENTS IN THE SOUTHERN ADRIATIC, THE WEST COAST OF SICILY AND THE VATICAN CAPE, PRELIMINARY REPORT [RAPPORTO PRELIMINARE SUI RISULTATI DELLE MISURE IDROLOGICHE NELL'ADRIATICO MERIDIONALE, NEL GOLFO DI TARANTO, AL LARGO DELLA COSTA ORIENTALE DELLA SICILIA E A CAPO VATICANO]

F. BIGNAMI, G. DIDONFRANCESCO, L. PAMPALONI, and P. SBRICCOLI 28 Mar. 1986 92 p In ITALIAN
(PREPRINT-502; ETN-86-97933) Avail: NTIS HC A05/MF A01

A hydrological campaign was carried out in order to study the deep waters of the Adriatic and Ionic seas. Satellite data indicating the presence of turbulence were to be verified. The vertical profiles of temperatures, salinity, and density were obtained. Ship position was estimated using the Loran C method. The instruments included echo sounding equipment and bathymeters. The detailed data is presented. ESA

N86-32077# World Climate Programme, Geneva (Switzerland). Scientific Committee for Oceanic Research.

WORLD CLIMATE RESEARCH PROGRAM. GENERAL CIRCULATION OF THE SOUTHERN OCEAN: STATUS AND RECOMMENDATIONS FOR RESEARCH, A REPORT BY SCOR WORKING GROUP 74

Oct. 1985 65 p
(WCP-108; WMO/TD-86; ETN-86-97252) Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

Major gaps in the knowledge of the general circulation of the Southern Ocean, bearing in mind its relevance to biology and climate were identified. Physical and chemical programs to investigate these problems were outlined. Interactions between the Southern Ocean and the subtropics; the Antarctic circumpolar current; the subpolar zone; shelf-slope processes and deep water formation; sea level observations; and air sea ice interaction were discussed. ESA

N86-32081# Rome Univ. (Italy). Dipt. di Fisica.

PRELIMINARY REPORT ON THE HYDROLOGICAL MEASUREMENTS CARRIED OUT IN THE SOUTHERN TYRRHENIAN SEA AND IN THE MESSINA STRAIT [RAPPORTO PRELIMINAIRE SUI RISULTTATI DELLE MISURE IDROLOGICHE ESEGUITE NEL TIRRENO MERIDIONALE E NELLO STRETTO DI MESSINA]

L. CAPITANIO, R. DORAZIO, G. PINO, L. FEDERICO, M. PALELLI, A. PACE, E. SALUSTI, J. SANEMETERIO, E. SIESNI, and E. ZAMBIANCHI 16 Dec. 1985 43 p In ITALIAN
(PREPRINT-489; ETN-86-97923) Avail: NTIS HC A03/MF A01

An oceanographic campaign was carried out to verify satellite observation data. The measurements include temperature, salinity and density profiles. The detailed data is presented. Computer processed data analysis is also presented. ESA

N86-32794 Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.

THE OCEANIC LITHOSPHERE: SEISMOLOGY AND TECTONICS

E. A. OKAL *In* CNES International Geophysics and Space p 341-368 1985
Avail: CEPADUES, Toulouse, France

The history of plate tectonics and the contribution of seismology to it are summarized. Seismology and the structure of the oceanic plates; intraplate earthquakes and the state of stress of the oceanic lithosphere; and active tectonism on the oceanic plates are discussed. ESA

N86-32805# Centre National d'Etudes Spatiales, Toulouse (France). Service ARGOS.

THE 10TH ARGOS USERS CONFERENCE

1985 301 p Conference held in Kiel, West Germany, 21-23 May 1985; sponsored in cooperation with Intergovernmental Oceanographic Commission, WMO and Kiel Univ.
(ETN-86-97267) Avail: NTIS HC A14/MF A01

Uses of the ARGOS system in oceanography, meteorology, polar regions, and environmental studies was discussed. ESA

N86-32806# British Columbia Univ., Vancouver. Dept. of Oceanography.

ON THE RELATIONSHIP BETWEEN LONG-TERM DRIFTER TRAJECTORIES AND MEAN SEASONAL DISTRIBUTIONS OF GEOSTROPHIC WIND AND BAROCLINIC OCEAN CURRENT IN THE EASTERN NORTH ATLANTIC

W. J. EMERY, J. STAHLMANN (Kiel Univ., West Germany), and W. KRAUSS *In* CNES The 10th ARGOS Users Conference 27 p 1985
Avail: NTIS HC A14/MF A01

A 4 yr collection of trajectories from 100 satellite tracked drifting buoys in the North Atlantic is analyzed to determine the correspondence of buoy trajectories with mean seasonal distributions of geostrophic wind (sea level atmospheric pressure) and baroclinic ocean current (0/1500 db dynamic topography). Buoy positions were interpolated to 3 hr intervals then averaged over 60 hr and smoothed with a 3-month running mean and separated into winter and summer seasons. Visual comparison between smooth trajectories and winter/summer averages of atmospheric pressure and baroclinic ocean current suggests the stronger influence of the wind field upon the character of long term trajectories compared to that of the baroclinic current. Statistical comparisons between buoy and geostrophic wind speed and direction reveal strong correlations only in the south (10 to 30 N) where seasonal variations of atmospheric pressure are small. In the north (40 to 50 N) overall mean directions agree well, while low correlations are due to interannual changes in the winter sea-level pressure distributions. ESA

N86-32807# Dundee Univ. (Scotland). Physics Lab.

SYSTEM ARGOS, SEA SURFACE TEMPERATURES AND CIRCULATION PATTERNS IN THE NORTHERN ATLANTIC

A. P. CRACKNELL and R. D. CALLISON *In* CNES The 10th ARGOS Users Conference 9 p 1985
Avail: NTIS HC A14/MF A01

The accuracy of TIROS-N satellites AVHRR-derived sea surface temperatures (SST) is discussed. The possibility of using thermal infrared scanner data for studying ocean currents and circulation patterns, with data obtained via System ARGOS, for the North Atlantic is considered. Differences between measured and satellite derived SST are 0.3 to 0.4 K. ESA

N86-32809# Oceanor, Trondheim (Norway).

TECHNICAL EXPERIENCE WITH THE ARGOS SYSTEM FOR TRANSMISSION OF OCEANOGRAPHICAL DATA

S. E. HANSEN *In* CNES The 10th ARGOS Users Conference 11 p 1985
Avail: NTIS HC A14/MF A01

Oceanographical instruments and moorings equipped with ARGOS systems are described. Current meters, waveriders, buoys, and thermistor/salinity strings are presented. Problems with access to the ARGOS data center, and the limited data storage facilities (only 24 hr data are buffered) are mentioned. ESA

N86-32810# Oceanor, Trondheim (Norway).

THE IMPORTANCE OF MEASURING CURRENT, WAVES AND OTHER ENVIRONMENTAL PARAMETERS IN ORDER TO IMPROVE THE CURRENT FORECAST SERVICE

S. E. HANSEN *In* CNES The 10th ARGOS Users Conference 15 p 1985

Avail: NTIS HC A14/MF A01

A current forecasting service to predict occurrences of high velocity current whirls in the Norwegian coastal current was established. It is relatively successful, but has difficulties due to lack of data in real time. Further observation has to be supplied in real time along the Skagerrak coast, and NW of Stavanger. ESA

N86-32811# Kiel Univ. (West Germany). Inst. fuer Meereskunde.

THE CURRENT SYSTEM OF THE NORTH ATLANTIC AS DEDUCED FROM DRIFTING BUOYS

W. KRAUSS *In* CNES The 10th ARGOS Users Conference 24 p 1985

Avail: NTIS HC A14/MF A01

More than 100 buoys were launched in the North Atlantic to analyze the large-scale circulation and the eddy intensities in the northern and eastern part of the North Atlantic. Results reveal a current system which predominantly transports water masses from the area southeast of Flemish Cap to the northeastern North Atlantic. A broad band (1500 km) of eddies is associated with the current; they exchange water masses across the Subarctic Front and yield intensive mixing of subtropical and polar waters. The subtropical anticyclonic gyre appears as an almost separate circulation system. The eastern recirculation of this gyre, however, receives a distinct amount of water from the area between the Azores and the Bay of Biscay. ESA

N86-32813# Institut Francais de Recherche pour l'Exploitation de la Mer, Brest (France).

ON BOARD SPECTRAL SEA-STATE: THE SPEAR F BUOY INPUTS TO ERS-1 CALIBRATION AND VALIDATION PHASE

R. EZRATY and G. AYELA *In* CNES The 10th ARGOS Users Conference 16 p 1985

Avail: NTIS HC A14/MF A01

Sea-state measuring buoys built from a waverider sensor and hull into which a dedicated onboard microprocessor computes the omnidirectional sea state spectrum and transmits the results through the ARGOS system are presented. Field tests show that this system of on-board spectral analysis works correctly and can discriminate complex sea state conditions. It can be mounted by any user, with no buoy modification, on existing waveriders. Although developed for a calibration experiment for satellite altimeters, it can be used in coastal areas where the 27 MHz Citizen Band is overcrowded, solving the problem of radio interferences and data integrity. Using the ARGOS system, a high cost dedicated receiving station and a data acquisition and processing systems are no longer needed. ESA

N86-32814# Etablissement d'Etudes et de Recherches Meteorologiques, Brest (France).

THE USE OF SPATIAL TECHNIQUES FOR A BETTER CURRENT SURFACE KNOWLEDGE, WITH APPLICATION TO THE SOUTHERN OCEAN

N. DANIAULT and Y. MENARD (Centre National d'Etudes Spatiales, Toulouse, France) *In* CNES The 10th ARGOS Users Conference 19 p 1985

Avail: NTIS HC A14/MF A01

The eddy kinetic energy distribution in the Southern Ocean was estimated from SEASAT altimeter data and from 192 free drifting buoy trajectories. The ARGOS system was used for positioning of the buoys. A good spatial coherence is found between the results of the two methods. The distribution shows strong eddy kinetic activity near the western boundaries and near topographic features. The ratio between both estimates was very high, with kinetic energy distribution from drifters being three times larger than from the altimeter. The drifters eddy kinetic energy distribution was recomputed and processed through a bandpass filter, giving a better match. Remaining differences are attributed to nonsimultaneity of the two data bases. ESA

N86-32815# Norwegian Meteorological Inst., Blindern.

THE NORWEGIAN METEOROLOGICAL INSTITUTE'S USE OF THE ARGOS SYSTEM

C. K. JENSEN *In* CNES The 10th ARGOS Users Conference 12 p 1985

Avail: NTIS HC A14/MF A01

The use of the ARGOS system technical equipment; the location of stations; advantages and disadvantages of using a local user terminal station, and the collection and control of data are discussed. ESA

N86-32816# Direction de la Meteorologie Nationale, Brest (France).

A DRIFTING BUOY EXPERIMENT AS PART OF COST-43

P. BLOUCH and T. KVINGE (COST-43 Technical Secretariat, Bergen, Norway) *In* CNES The 10th ARGOS Users Conference 11 p 1985

Avail: NTIS HC A14/MF A01

The System of Operational Buoys in the Atlantic program is described. A zone with few observations from ships was chosen. At least two buoys must be maintained drifting at sea and operational in the area at all times throughout a period of at least 3 yr. The buoys must provide meteorological, oceanographic and position data via the ARGOS system. As with FGGE, the observations must include at least air pressure and sea surface temperature. The date must be available in real-time via the Global Telecommunication System of the World Meteorological Organization in the DRIBU code and/or SHIP code. Archived data must be retrievable through ARGOS Service and must be available on request to other COST-43 members. There are no plans to recover the buoys. ESA

N86-32817# Christian Michelsens Institutt for Videnskap og Andsfrihet, Bergen (Norway). Dept. of Science and Technology.

REPORT ON ICE BUOYS IN THE ARCTIC AND THE ANTARCTIC

N. S. NERGAARD *In* CNES The 10th ARGOS Users Conference 19 p 1985

Avail: NTIS HC A14/MF A01

The status of over 20 buoys dropped by parachute onto polar ice is reported. Data from the buoys suggest an average export speed for ice conveyed from the Arctic Ocean by the Transpolar Drift Stream through the Fram Strait of 10 cm/sec, with a variation in the central area of 5 to 70 cm/sec. The buoys are tracked by the ARGOS system. ESA

N86-32818# Bergen Univ. (Norway).

EXPERIENCE AND RESULTS FROM USE OF ARGOS TRACKED BUOYS DURING MIZEX 83 AND 84

B. A. FARRELLY *In* CNES The 10th ARGOS Users Conference 13 p 1985

Avail: NTIS HC A14/MF A01

During the Marginal Ice Zone Experiment, ships, aircraft, and satellites tracked ARGOS buoys on the ice and in the open sea in the Fram Strait. Buoy positions and other information were relayed to the field coordinator to update experiment plans. This proved invaluable for buoy recovery and for giving details of ice movement and ocean currents. Ice kinematics derived from ARGOS buoys and from aircraft remote sensing are presented. Since several of the ice platforms acquiring meteorological and oceanographic data were tracked by ARGOS, the balance of forces on the ice could be estimated. ESA

N86-32820# High Arctic Consulting Ltd., Raahe (Finland).
USE OF AN ARGOS PLATFORM ON AN EXPEDITION TO THE NORTH POLE 1984
M. TERVASKANTO *In* CNES The 10th ARGOS Users Conference 10 p 1985
Avail: NTIS HC A14/MF A01

Use of an ARGOS platform for location, data transfer, and emergency communication during a polar expedition is described. The equipment withstood the rough handling and low temperatures (down to minus 56 C) well mechanically, but displays froze and the PTT occasionally changed all the data bits to ones. ESA

N86-32821# Societe Nationale Elf Acquitaine, Paris (France).
ENVIRONMENTAL AND METEOROLOGICAL DATA ACQUISITION SYSTEM WITH INTEGRATED ARGOS TRANSMITTER: IMPROVEMENT IN SEA STATE FORECAST FOR CRITICAL OFFSHORE OPERATIONS
R. CARTON, S. ANTALOVSKY (SYMINEX, Marseille, France), and D. SEMBRESQ *In* CNES The 10th ARGOS Users Conference 12 p 1985
Avail: NTIS HC A14/MF A01

The use of the Environmental and Meteorological Data Acquisition Systems (EMDAS) equipped with an ARGOS link to increase the reliability of seastate forecasts in offshore areas, thus optimizing the cost and safety of offshore operations is described. In spite of the relatively small amount of information transmitted by ARGOS, several months experience confirms the operational value of the EMDAS-ARGOS system and proves that extensions to other fields (in-service monitoring and others) are possible. However, hardware and software improvements are needed to improve data recovery. ESA

N86-32823# Oregon State Univ., Newport. Hatfield Marine Science Center.
PRELIMINARY TECHNICAL EVALUATION OF AN ARGOS-MONITORED RADIO TAG FOR TRACKING MANATEES
B. MATE, G. RATHBUN (Fish and Wildlife Service, San Simeon, Calif.), R. MERRICK, and J. REED (Fish and Wildlife Service, Gainesville, Fla.) *In* CNES The 10th ARGOS Users Conference 5 p 1985
Avail: NTIS HC A14/MF A01

A radio tagged manatee was released into a river leading to subtropical waters and tracked by satellite. Up to 8 locations a day are reported. The manatee remained in the river system, but is expected to head for the Gulf of Mexico. ESA

N86-32825# National Museum of Natural History, Marseille (France).
BEHAVIOR OF DERMOCHELYS CORIACEA IN CAPTIVITY (ANIMAL CARRYING DUMMY PTT IN PRELIMINARY PHASE OF AN ARGOS EXPERIMENT)
M. DURON-DUFRENNE *In* CNES The 10th ARGOS Users Conference 15 p 1985
Avail: NTIS HC A14/MF A01

The degree to which a turtle would accept the Transat-type ARGOS PTT, and the reliability of the harness securing it to the carapace were tested, using an adult kept in a swimming pool for 36 hr. Its pelagic behavior turns out to be comparable to that in the open sea, the animal appearing unperturbed by the equipment. ESA

N86-32826# Institut Francais de Recherche pour l'Exploitation de la Mer, Nantes (France).
ARGOS AND FISHING
C. LEROY, C. LEROY, and L. MERCIER (CEIS-Espace, Toulouse, France) *In* CNES The 10th ARGOS Users Conference 10 p 1985
Avail: NTIS HC A14/MF A01

The ARGOS system contributions to tuna finding in the NE Atlantic, and shrimp trawling on the Continental Shelf off French Guiana are described. Tuna catch data and environmental measurements transmitted from a shipboard keypad terminal are integrated in a wider aid-to-fish-finding strategy centered on the generation of sea surface temperature maps using thermal infrared imagery. Useful data are then retransmitted to the tuna boats by facsimile. The program to aid shrimp trawling includes use of onboard PTT, and a microcomputer to generate the catch and environment message. ESA

N86-32827# South African Weather Bureau, Pretoria.
THE SOUTH AFRICAN CONTRIBUTION TO TOGA
P. LEROUX *In* CNES The 10th ARGOS Users Conference 3 p 1985
Avail: NTIS HC A14/MF A01

Drifting buoys and automatic weather stations were used in the Tropical Ocean Global Atmosphere program. Information on oceanographic parameters in the South Atlantic and Southern Indian Ocean, and surface and upper air data are collected. ESA

N86-32859# Royal Aircraft Establishment, Farnborough (England).
MONITORING ICEBERG PRODUCTION USING LANDSAT DATA
R. V. BIRNIE (MacAulay Inst. for Soil Research, Aberdeen (Scotland).) and J. M. WILLIAMS *In* ESA Remote Sensing Applications in Civil Engineering p 165-167 Mar. 1985
Avail: NTIS HC A06/MF A01

The use of Landsat MSS data to monitor iceberg production from west Greenland glaciers was studied. The importance of such data to iceberg management in oilfields off Labrador and Newfoundland is underlined. Most of the freshwater icebergs found off eastern Canada originate from west Greenland glacier sources and it is known that on average it takes 2 to 3 yr for icebergs to drift, first north in the west Greenland current, then south through the Davis Straight in the Labrador current. The study suggests that it is possible to do an annual census of iceberg production from the major west Greenland glacier sources to predict ice conditions around drilling sites up to 3 years in advance. ESA

N86-32861# National Remote Sensing Agency, Hyderabad (India).
OPTICAL REMOTE SENSING FOR COASTAL ZONE MANAGEMENT
I. V. MURALIKRISHNA *In* ESA Remote Sensing Appl. in Civil Eng. p 175-191 Mar. 1985
Avail: NTIS HC A06/MF a01

Remote sensing application to engineering problems in coastal zone management in intertropical regions is discussed. Studies of aquatic suspended sediment patchiness and tidal vortices are described. The capability of remotely sensed satellite data to monitor the effects of littoral processes is shown. The utility of proposed sensors is assessed. ESA

N86-32862# National Oceanic and Atmospheric Administration, Washington, D. C. Satellite Applications Lab.
AN EXPERIMENTAL TECHNIQUE FOR PRODUCING MOISTURE CORRECTED IMAGERY FROM 1 KM ADVANCED VERY HIGH RESOLUTION RADIOMETER (AVHRR) DATA
E. MATURI, J. PRITCHARD, and P. CLEMENTE-COLON Jun. 1986 34 p
(NOAA-TM-NESDIS-15) Avail: NTIS HC A03/MF A01

Removal of atmospheric moisture from infrared measurements of the sea surface, allows for better detection of sea surface temperature gradients. A multispectral processing technique is applied to 1 km AVHRR data to correct for moisture. The resulting data is then feature enhanced and converted to imagery. This process and the applications of the moisture corrected imagery are presented. Author

N86-32929# Naval Oceanography Command Center/Joint Typhoon Warning Center, FPO San Francisco, Calif.

FORECAST VERIFICATION AND RECONNAISSANCE DATA FOR SOUTHERN HEMISPHERE TROPICAL CYCLONES Technical Note, 1 Jul. 1982 - 30 Jun. 1984

W. P. WIRFEL and S. A. SANDGATHE Feb. 1986 106 p
(AD-A168274; NOCC/JTWC-TN-86-1) Avail: NTIS HC A06/MF A01 CSCL 04B

This report documents tropical cyclones which developed in the South Indian Ocean and South Pacific Ocean from 1 July 1982 to 30 June 1984. It provides composite storm best-tracks, a brief summary of each year's tropical cyclone season, and detailed position and reconnaissance fix data. In addition, this report contains forecast accuracy statistics for Southern Hemisphere tropical cyclones. A total of 55 tropical cyclones reached warning status in the combined Joint Typhoon Warning Center and Naval Western Oceanography Center area of responsibilty between 1 July 1982 and 30 June 1984. Twenty-five attained warning status in the 1982 to 1983 season, with thirty reaching warning status in the 1983 to 1984 season. Intensity estimates for Southern Hemisphere tropical cyclones are derived primarily from satellite imagery evaluation (Dvorak, 1973) and from intensity estimates reported by other regional warning centers. In very rare instances, the intensity estimates are based on surface observational data. Estimates of the minimum sea-level pressure are usually derived from the Atkinson and Holliday (l977) realtionship between the maximum sustained 1-min. surface wind and the minimum sea-level pressure. GRA

06

HYDROLOGY AND WATER MANAGEMENT

Includes snow cover and water runoff in rivers and glaciers, saline intrusion, drainage analysis, geomorphology of river basins, land uses, and estuarine studies.

A86-40658* South Dakota School of Mines and Technology, Rapid City.

THE AREA-TIME-INTEGRAL TECHNIQUE TO ESTIMATE CONVECTIVE RAIN VOLUMES OVER AREAS APPLIED TO SATELLITE DATA - A PRELIMINARY INVESTIGATION

A. A. DONEAUD, J. R. MILLER, JR., L. R. JOHNSON (South Dakota School of Mines and Technology, Rapid City), T. H. VONDER HAAR, and P. LAYBE (Colorado State University, Fort Collins) IN: Conference on Hydrometeorology, 6th, Indianapolis, IN, October 29-November 1, 1985, Preprints. Boston, MA, American Meteorological Society, 1985, p. 238-245. refs
(Contract NAG5-386)

A86-43445

DRAMATIC EXAMPLES OF THUNDERSTORM TOP WARMING RELATED TO DOWNBURSTS

G. ELLROD (NOAA, Satellite Applications Laboratory, Washington, DC) National Weather Digest (ISSN 0028-0712), vol. 10, May 1985, p. 7-13. refs

Examples of rapid thunderstorm top warming as observed in satellite infrared imagery are related to the occurrence of straightline or downburst wind damage at the surface. The events were observed over the southern United States in early May 1984. Two types of warming patterns were observed: (1) small, circular dark areas embedded within the anvil, and (2) a wedge-shaped darkening area near the upwind portion of the anvil. Both occurred to the rear of the coldest IR tops and locations of surface wind damage. Evaporative cooling is believed to have been a contributor in the latter case. Author

A86-43452* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

OXYGEN BUDGET OF A PERENNIALLY ICE-COVERED ANTARCTIC LAKE

R. A. WHARTON, JR., C. P. MCKAY (NASA, Ames Research Center, Moffett Field, CA), G. M. SIMMONS, JR., and B. C. PARKER (Virginia Polytechnic Institute and State University, Blacksburg) Limnology and Oceanography (ISSN 0024-3590), vol. 31, no. 2, 1986, p. 437-443. refs
(Contract NSF DPP-79-23996; NSF DPP-80-12988)

A bulk O2 budget for Lake Hoare, Antarctica, is presented. Five years of seasonal data show the lake to be persistently supersaturated with O2. Oxygen is carried into the lake in glacial meltstreams and is left behind when this water is removed as ice by ablation and sublimation. A diffusive loss of O2 from the lake through the summer moat is suggested. Measured values of the total O2 in the water column indicate that the time scale of O2 turnover is much longer than a year. Based on these results, it is suggested that the amount of O2 in the water does not change significantly throughout the year and that the lake is also supersaturated with N2. Author

A86-44049

THE ROLE OF REMOTELY SENSED DATA IN STUDIES OF THE THERMAL BAR

J. R. SCHOTT (Rochester Institute of Technology, NY) Remote Sensing Reviews (ISSN 0275-7257), vol. 1, pt. 2, 1986, p. 341-358. refs

Sample imagery are presented to illustrate the effectiveness of Heat Capacity Mapping Mission (HCMM) data for monitoring the thermal bar in Lake Ontario. A thermal bar is an area in dimictic lakes in which water areas chilled or warmed in the winter or summer, respectively, stratify without mixing. The phenomenon can vary from location to location in the lake, and has a significant impact on the turbidity and bacteria content and distribution within the lake and on the diffusion of pollutants. The HCMM data were used to generate isothermal maps which were compared with color aerophotography images. Actual lake surface temperatures were derived from the satellite data, which was useful for interpreting Landsat data of the same area. It is concluded that higher resolution, more frequent IR data would be effective at tracking the location and evolution of thermal bar features in large bodies of water. M.S.K.

A86-44174*# Geological Survey, Flagstaff, Ariz.

PALEODRAINAGES OF THE EASTERN SAHARA - THE RADAR RIVERS REVISITED (SIR-A/B IMPLICATIONS FOR A MID-TERTIARY TRANS-AFRICAN DRAINAGE SYSTEM)

J. F. MCCAULEY, C. S. BREED, G. G. SCHABER (USGS, Flagstaff, AZ), W. P. MCHUGH (GAI Cousultants, Inc., Pittsburgh, PA), C. C. HAYNES (Arizona, University, Tucson) et al. IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 624-648. NASA-Army-supported research. refs

The images obtained by the Shuttle Imaging Radar (SIR)-A and -B systems over the southwestern Egypt and northwestern Sudan were coregistered with the Landsat images and the existing maps to aid in extrapolations of the buried paleodrainages ('radar rivers'), first discovered by SIR-A. Field observations explain the radar responses of three types of radar rivers, RR-1 (broad, aggraded valleys filled with alluvium), RR-2 (braided channels inset in the RR-1 valleys), and RR-3 (narrow, long, bedrock-incised channels). A generalized model of the radar rivers, based on field studies and regional geologic relations, shows inferred changes in river regimen since the large valleys were established during the later Paleogene-early Neogene. It is suggested that a former Trans-African master stream system may have flowed from headwaters in the Red Sea Hills southwestward across North Africa, discharging into the Atlantic at the Paleo-Niger delta, prior to the Neogene domal uplifts and building of volcanic edifices across the paths of these ancient watercourses. I.S.

A86-45175

JAPAN'S CS (SAKURA) COMMUNICATIONS SATELLITE EXPERIMENTS. VI E - COMMUNICATIONS EXPERIMENTS: EXPERIMENTS ON MEASURES AGAINST RAIN ATTENUATION

K. KOSAKA, Y. SUZUKI (Ministry of Posts and Telecommunications, Radio Research Laboratories, Koganei, Japan), I. NISHIYAMA (Ministry of Posts and Telecommunications, Kashima Space Research Center, Japan), T. KOHRI, and S.-I. EGAMI (Nippon Telegraph and Telephone Public Corp., Electrical Communications Laboratories, Yokosuka, Japan) IEEE Transactions on Aerospace and Electronic Systems (ISSN 0018-9251), vol. AES-22, May 1986, p. 302-309.

The following three techniques for measuring rain attenuation in 30/20 GHz satellite links are evaluated: (1) transmission power control, (2) site diversity, and (3) frequency band switching. With regard to transmission power control methods, uplink power control methods and up/downlink power control methods were examined. A closed-loop control technique incorporating up/downlink control was found to provide the most accuracy. For site-diversity methods, it was found that a better link quality was obtained when received signals were combined and the FEC technique was used. A frequency band switching technique was applied to a TDMA system; the 30/20 and 6/4 GHz bands were used simultaneously and transmitting frame formats changed according to the rain attenuation of the 30/20 GHz band. K.K.

A86-45289

RAIN ATTENUATION SUCCESSIVE FADE DURATIONS AND TIME INTERVALS BETWEEN FADES IN A SATELLITE-EARTH LINK

E. MATRICCIANI and M. MAURI (CNR, Centro di Studio per le Telecommunicazioni Spaziali; Milano, Politecnico, Milan, Italy) Electronics Letters (ISSN 0013-5194), vol. 22, June 5, 1986, p. 656-658.

Long-term attenuation data at 11.6 GHz, obtained in a Sirio link, are analyzed to provide information on the joint statistics between successive fade durations within a rain event (intrafade) and between different rain events (interfade). The results show that successive fade durations and the interfade or intrafade intervals are approximately statistically independent. Within the same rain event, interfades and fade durations longer than 10 s are statistically identical. These data may be important for planning adaptive systems and for devising prediction models of the dynamic behavior of rain attenuation. Author

A86-45378

THE USE OF SPACE REMOTE-SENSING DATA TO STUDY MASS TRANSFER IN GLACIER SYSTEMS [ISPOL'ZOVANIE MATERIALOV KOSMICHESKOI S'EMKI DLIA IZUCHENIIA MASSOOBMENA LEDNIKOVYKH SISTEM]

G. A. NOSENKO Geodeziia i Kartografiia (ISSN 0016-7126), May 1986, p. 26-31. In Russian. refs

A set of analytical-phototriangulation programs has been developed at the Priroda center for the investigation of mass transfer in glacier systems on the basis of space remote-sensing data. An appropriate block diagram is presented, and the effectiveness of the proposed approach is confirmed using data from glaciological experiments carried out during 1978-1983 with the Salyut 6 and 7 stations, and Cosmos satellites. B.J.

A86-45775

OBSERVATIONS OF THE SUSPENDED MATTER DISTRIBUTION DYNAMICS IN THE ELBE ESTUARY FROM TIME SERIES AERIAL PHOTOGRAPHS

R. DOERFFER (GKSS-Forschungszentrum Geesthacht, GmbH, West Germany) Internationale Revue der Gesamten Hydrobiologie (ISSN 0020-9309), vol. 70, no. 1, 1985, p. 127-150. refs

Series of aerial photographs taken with an interval of 6 minutes were used to study the dynamics of the suspended matter distribution in a 1 km section of the Elbe Estuary. The observations show heterogeneous distribution patterns which are different at each phase of the tidal cycle. The comparison with the bathymetry indicates that the distribution is mainly a function of the river bed topography, which modifies the local current structure. The surface distribution in the fairway region is especially determined by the ship traffic. Author

A86-46070

LAND USE AND LAND COVER MAPPING OF ZHUJIANG DELTA, CHINA, WITH LANDSAT DATA BY MANUAL AND COMPUTER-ASSISTED METHODS

C. P. LO (Georgia, University, Athens) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 212-221. Research supported by the University of Hong Kong. refs

A86-46073

AERIAL MONITORING OF EROSIONAL CHARACTERISTICS TO IMPROVE FLOOD CONTROL AND SEDIMENT MANAGEMENT - THE MOUNT ST. HELENS EXAMPLE

C. L. ROSENFELD, M. R. PARSONS (Oregon State University, Corvallis), and M. L. PEARSON (U.S. Army, Military Academy, West Point, NY) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 237-242.

A86-46091

A SAMPLING APPROACH TO IRRIGATED ACREAGE DETERMINATION IN THE GREEN RIVER BASIN OF WYOMING

J. P. VERDIN (U.S. Bureau of Reclamation, Denver, CO), C. M. HAY (Colorado State University, Fort Collins), and M. T. OGRADY (Wyoming Water Development Commission, Cheyenne) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 421-442. refs

Sharing a need for up-to-date irrigated acreage data, the State of Wyoming and the Bureau of Reclamation jointly undertook a program of inventory and technique development in the Green River Basin, a major subbasin of the Colorado River System. A census of irrigated and phreatophyte acreages was obtained from 1982 aerial photography with manual interpretation techniques. Recognizing that the value of these acreages would decreasse with time, a remote sensing aided inventory design, employing satellite imagery and sampling theory, was investigated as a means of obtaining more frequent and less costly acreage estimates than with a full census. Using data available from the adjacent Bear River Basin, a pilot study was performed to assess the efficiency and sensitivity of a two-step stratification and sampling approach. The findings of this study indicate that 95 percent accuracy could be obtained in the Green River Basin with full Landsat coverage and manual photointerpretation over only 51 percent of the irrigated area, at about one third the cost of a full census by aerial photography. Author

A86-46094* Cornell Univ., Ithaca, N.Y.

USE OF INDUCED FLUORESCENCE MEASUREMENTS TO ASSESS ALUMINUM-ORGANIC INTERACTIONS IN ACIDIFIED LAKES

A. VODACEK and W. D. PHILPOT (Cornell University, Ithaca, NY) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 460-469. refs
(Contract NGT-33-010-800)

The application of laser fluorosensing to the tracing of metals in acid lakes is proposed. The effects of the metals on the dissolving organic carbon (DOC) fluorescence is studied using laboratory mixed water samples and natural water samples from Hamilton and Big Moose Lakes in New York. The operation of the laser fluorosensing system employed in the experiment is described. The DOC fluorescence was quenched by Al, Cu, and Fe, and the relation between pH and the quenching rate is examined. The humic substances fluorescence spectra are analyzed to estimate the concentrations of DOC in water and the relative concentration of Al. The interference problems caused by chemical competition between metal ions and ligands, and changes in the background DOC fluorescence are discussed. It is noted that an airborne laser fluorescence is useful for detecting elevated concentrations of metals. I.F.

A86-46096

LANDSAT STUDIES OF SURFACE WATER OF LAKE CHICOT, ARKANSAS

J. C. RITCHIE (USDA, Agricultural Research Service, Beltsville, MD), F. R. SCHIEBE (USDA, Agricultural Research Service, Durant, OK), and C. M. COOPER (USDA, Agricultural Research Service, Oxford, MS) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 492-498. refs

The development of a system that uses Landsat MSS data for monitoring agricultural impoundments for suspended sediments is examined. Landsat MSS images of Lake Chicot, AK obtained from July 1976-November 1979 are analyzed. Ground measurements of total solids, suspended solids, and chlorophyll a in surface water were collected; the total solids ranged from 117-908 mg/liter, the suspended solids from 1-828 mg/liter, and chlorophyll a from 2-113 mg/cu m. The radiance and reflectance data and ground measurements are compared. Radiance and reflectance in MSS band 6 displayed the strongest correlation with total and suspended solids and band 5 corresponded with cholorophyll a. The data reveal that the wavelengths in the MSS band 6 region are most applicable for estimating suspended sediments. I.F.

A86-46116

A NEW APPLICATION OF THE NIMBUS-7 CZCS - DELINEATION OF THE 1983 PARANA RIVER FLOOD IN SOUTH AMERICA

D. R. WIESNET and M. DEUTSCH (Satellite Hydrology Associates, Falls Church, VA) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 746-754. Research supported by the Organization of American States. refs

The application of the Nimbus 7 satellite's Coastal Zone Color Scanner (CZCS) to flood mapping and post-flood delineation is proposed. The capabilities of the CZCS, which views the earth, sea, and land surface in six spectral bands with a resolution of 825 m are described. CZCS images of the 1983 Parana River Basin floods were analyzed using the VICOM digital image processor. It is observed from the CZCS data that the optimum band for drainage delineation is band 5, accurate details of the drainage are depicted on the CZCS images, and flood plain delineation and flood-hazard-area delineation are possible at a scale of 1:3,000,000 with high accuracy. I.F.

A86-48396

GEO INFORMATION SYSTEMS FOR LAND USE ZONING AND WATERSHED MANAGEMENT

A. M. J. MEIJERINK (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) ITC Journal (ISSN 0303-2434), no. 4, 1985, p. 283-287.

A program for the development of an integrated information system designed to collect and process data for the planning of the development and conservation of natural resources within a watershed area is described. Landsat band-7 images of the Komaring and Ogan river basins in southern Sumatra were evaluated. The program includes development of a user-friendly input system, the data base and a query language, mapping methods and coding systems for meteorology/climate and social/economic aspects of the regions, methods for modeling crop yield, hydrology, erosion, and conservation, systems for interaction with the watershed management, and monitoring systems. I.S.

A86-48957

THE USE OF SPOT-SIMULATED IMAGERY IN HYDROLOGICAL MAPPING

T. R. E. CHIDLEY (Aston, University, Birmingham, England) and R. S. DRAYTON (University College, Cardiff, Wales) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, June 1986, p. 791-799. refs

The fine spatial resolution offered by the SPOT system promises great improvements in the mapping of surface water and drainage networks. Simulated SPOT imagery of sites covering a variety of landscape units in Wales were examined. Identification of streams on the basis of spatial characteristics alone was found to be inefficient, and the use of thematic information was found beneficial. Strategies for interactive image enhancement are discussed, and the results of a visual interpretation of standard photoproducts are presented. The results of the interpretation of simulated SPOT data are compared with results of an interpretation of Landsat MSS data. Author

A86-48960

PIXEL-MIXING EFFECTS AND THEIR SIGNIFICANCE TO IDENTIFYING SNOW CONDITION FROM LANDSAT MSS DATA

R. V. BIRNIE (Macaulay Institute for Soil Research, Aberdeen, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, July 1986, p. 845-853. Research supported by the Highlands and Islands Development Board. refs

Radiometric measurements on snow in Landsat MSS wavebands have shown a correlation between snow condition and the ratio of green/infrared (band 4/band 7) wavebands. Systematic changes from wet dense snow at low altitudes to dry less dense snow at higher altitudes should be revealed by a decrease in the intensity ratio band 4/band 7 with altitude. However, analysis of spring Landsat MSS images for the Cairngorm Mountains shows that the intensity ratio band 4/band 7 actually increases with altitude. A mixed-pixel hypothesis is invoked to account for this pattern. The results suggest that only in areas where the snow cover is continuous can information on snow condition be reliably obtained from Landsat MSS data. Author

A86-49482

APPLICATION OF THERMAL INFRARED REMOTE SENSING IN WATER MANAGEMENT OF HUMID AND ARID AREAS

G. J. A. NIEUWENHUIS and M. MENENTI (Instituut voor Cultuurtechniek en Waterhuishouding, Wageningen, Netherlands) Geocarto International, no. 1, 1986, p. 35-46. refs

Regional evapotranspiration can be estimated with the equilibrium surface temperature and surface reflectance, both of which can be measured with scanning radiometers from airplanes or satellites. In case of vegetation covered soils information about the availability of soil moisture in the root zone can be obtained with the vegetation itself. For bare soil conditions the surface temperature variation in space and time supplies information about evaporation losses and apparent surface thermal admittance. In this paper the applicability of remotely sensed thermal images for vegetation covered and bare soil conditions is demonstrated by presenting some results of investigations in the Netherlands and Libya. In humid areas like the Netherlands in the near future the application of remote sensing will be mainly based on scanning techniques from airplanes. Satellite systems are of great importance in studying the water management in arid areas. Author

A86-49510

THE TURBIDITY OF MOUNT ST. MICHAEL BAY (FRANCE), FROM A SPOT SIMULATION [LES TURBIDITES DE LA BAIE DU MONT-SAINT-MICHEL (FRANCE), A PARTIR D'UNE SIMULATION SPOT]

R. ZBINDEN (Ecole Normale Superieure, Montrouge, France) Photo Interpretation (ISSN 0031-8523), vol. 24, Jan.-Feb. 1985, p. 1-5, 7. In French, English, and Spanish.

Aerophotographic images were obtained of Mount St. Michael Bay for comparisons with ground truth data and simulated SPOT images scene. The effort was part of the calibration of SPOT images, in this case for monitoring river sedimentation, coastal processes, and the effects of human activities. The ground truth studies included sampling suspended particulates to determine the composition, dry weights and sizes, and the areal distributions within the bay. The data were used to color-code the simulated SPOT images for regions of decreasing turbidity. The in-situ data showed that the images only revealed the surface particulate densities, which could change significantly with depth. Turbidity fronts could be identified, as could regions which did not suffer intrusion, a factor which makes the SPOT data valuable for coastal zone management. M.S.K.

A86-49647

A CASE STUDY EVALUATION OF SATELLITE-DERIVED RAINFALL ESTIMATES

G. A. FIELD (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) IN: Conference on Hydrometeorology, 6th, Indianapolis, IN, October 29-November 1, 1985, Preprints. Boston, MA, American Meteorological Society, 1985, p. 296-304. Research supported by the University of Wisconsin. refs

An evaluation of satellite rainfall estimates of the 32.5-41 deg N and 86-101 deg W region obtained between July 20 and July 21, 1981, and computed using the Scofield-Oliver Convective Rainfall Estimation Technique on the University of Wisconsin Man-Computer Interactive Data Access System, is presented. Comparison with over 300 rainfall observations revealed accuracies to within 30 percent in magnitude, and 10-20 miles in location. Discrepancies are discussed, and the importance of the density of observations when attempting to verify on a grid point for grid point basis is demonstrated. R.R.

A86-49648

OPERATIONAL APPLICATION OF THE NESDIS EXTRATROPICAL CYCLONE PRECIPITATION ESTIMATION TECHNIQUE TO WEST COAST WINTER STORMS

S. J. KUSSELSON (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) IN: Conference on Hydrometeorology, 6th, Indianapolis, IN, October 29-November 1, 1985, Preprints. Boston, MA, American Meteorological Society, 1985, p. 310-315. refs

Two operationally analyzed winter storm events which produced heavy precipitation in Oregon and California are discussed. It is shown how the Synoptic Analysis Branch (SAB) of the National Environmental, Satellite, Data and Information Service (NESDIS) used satellite imagery to locate and track the heavy precipitation. Infrared and surface maps of the storms are shown, and the SAB's operational precipitation estimates are compared with observed reports. C.D.

A86-49649

SATELLITE-DERIVED RAINFALL ESTIMATES AND SHORT-RANGE FORECAST IMPLICATIONS FOR AN INTENSE HEAVY RAIN EVENT IN THE SPRING OF 1984

D. CLARK (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) IN: Conference on Hydrometeorology, 6th, Indianapolis, IN, October 29-November 1, 1985, Preprints. Boston, MA, American Meteorological Society, 1985, p. 216-220.

N86-28493# Innsbruck Univ. (Austria). Inst. fuer Meteorologie und Geophysik.

TOWARDS A SAR SYSTEM FOR SNOW AND LAND ICE APPLICATIONS

H. ROTT, G. DOMIK (Vexcell Corp., Boulder, Colo.), C. MAETZLER (Bern Univ. Switzerland), and H. MILLER (Alfred-Wegener-Inst. for Polar Research, Bremerhaven, West Germany) *In* ESA Proceedings of a Workshop on Thematic Applications of SAR DATA p 29-39 Dec. 1985

Avail: NTIS HC A06/MF A01

The characteristics of a SAR system for snow and land ice monitoring and possible applications are considered. Characteristics of backscattering from snow and ice are discussed. Examples for radar image simulations which provide information on required antenna look angle and spatial resolution for snow cover monitoring are given. Preliminary specifications for a SAR system for snow and land ice monitoring are outlined. ESA

N86-28502# Innsbruck Univ. (Austria). Inst. fuer Meteorologie und Geophysik.

STUDY ON USE AND CHARACTERISTICS OF SAR FOR LAND SNOW AND ICE APPLICATIONS Final Report

H. ROTT, G. DOMIK, C. MAETZLER, H. MILLER, and K. G. LENHART Paris ESA May 1985 164 p

(Contract ESA-5441/83-D-IM(SC))

(REPT-1(1985); ESA-CR(P)-2168; ESA-86-96867) Avail: NTIS HC A08/MF A01

Synthetic aperture radar systems for snow and land ice monitoring were investigated to define a land observation satellite mission. Applications and requirements for remote sensing of land cryosphere parameters are discussed. The physical background on scattering from snow and ice is discussed and results of backscattering measurements are compared with other investigations. Examples for spaceborne and airborne SAR data on snow and glaciers are provided and information for the interpretation of the radar image data is given. Synthetic radar images were generated for two test areas with different topography to define the optimum antenna look angle. Simulations based on real SAR data provided information on spatial resolution and signal to noise ratio. Promising applications and preliminary specifications for a SAR system on land cryosphere monitoring are presented. ESA

N86-28597# Electronic Techniques, Inc., Fort Collins, Colo.

SCPP (SIERRA COOPERATIVE PILOT PROJECT) METEROLOGICAL AND STATISTICAL SUPPORT, VOLUME 1 Interim Progress Report, 1 Sep. 1984 - 31 Aug. 1985

A. W. HUGGINS, J. O. RHEA, G. L. HEMMER, A. P. KUCIAUSKAS, and C. J. WILCOX Oct. 1985 250 p Sponsored by Bureau of Reclamation

(PB86-189404) Avail: NTIS HC A11/MF A01 CSCL 04B

Field operations and data collection procedures for the Sierra Cooperative Pilot Project (SCPP) forecast office, radar and rawinsondes are described. A series of analyses by ETI and NAWC scientists is presented. Seeding effects in radar data are described for convective clouds seeded with CO2 and AgI. The passage of certain radar echoes was found to be associated with lowering cloud top and an increase in supercooled liquid water (SLW) at Kingvale. In conjunction with satellite data such correspondence may be used to help predict the occurrence of clouds suitable for seeding experiments. GRA

N86-29293*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ANALYSIS OF RAINFALL OVER NORTHERN PERU DURING EL NINO: A PCDS APPLICATION

R. GOLDBERG and G. TISNADO (Instituto Nacional de Investigacion de Transportes (Peru).) *In its* Proceedings of the Second Pilot Climate Data System Workshop 23 p 1986

Avail: NTIS HC A12/MF A01 CSCL 04B

In an examination of GOES satellite data during the 1982 through 1983 El Nino period, the appearance of lee wave cloud patterns was revealed. A correlation was hypothesized relating an anomalous easterly flow across the Andes with the appearance of these wave patterns and with the subsequent onset of intense rainfall. The cloud patterns are belived to be associated with the El Nino period and could be viewed as precursors to significant changes in weather patterns. The ultimate goal of the researchers will be the ability to predict occurrences of rainstorms associated with the appearance of lee waves and related cloud patterns as harbingers of destruction caused by flooding, huaycos, and other catastrophic consequences of heavy and abnormal rainfall. Rainfall data from about 70 stations in northern Peru from 1980 through 1984 were formatted to be utilized within the Pilot Climate Data System (PCDS). This time period includes the 1982 through 1983 El Nino period. As an example of the approach, a well-pronounced lee wave pattern was shown from a GOES satellite image of April

4, 1983. The ground truth data were then displayed via the PCDS to graphically demonstrate the increase in intensity and areal distribution of rainfall in the northern Peruvien area in the next 4 to 5 days. Author

N86-31089# Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (West Germany).

HYDROLOGY

W. KRUCK and P. PAMPALONI (Consiglio Nazionale delle Ricerche, Florence, Italy) *In* DFVLR The X-SAR Science Plan p 75-95 Nov. 1985

Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 32

Hydrological parameters that can be studied by spaceborne imaging radar are listed. Test sites for X-SAR/SIR-C mission remote sensing of precipitation and surface runoff; ground water, evaporation, and evapotranspiration; and soil moisture, and surface and radar penetration parameters are proposed. ESA

N86-31943*# National Marine Fisheries Service, Miami, Fla.

UTILIZING REMOTE SENSING OF THEMATIC MAPPER DATA TO IMPROVE OUR UNDERSTANDING OF ESTUARINE PROCESSES AND THEIR INFLUENCE ON THE PRODUCTIVITY OF ESTUARINE-DEPENDENT FISHERIES Semiannual Progress Report

J. A. BROWDER, L. N. MAY, JR. (Louisiana State Univ., Baton Rouge), A. ROSENTHAL, R. H. BAUMANN, and J. G. GOSSELINK 10 Jun. 1986 66 p Sponsored by NASA

(NASA-CR-177177; NAS 1.26:177177; SAPR-2) Avail: NTIS HC A04/MF A01 CSCL 08G

LANDSAT thematic mapper (TM) data are being used to refine and validate a stochastic spatial computer model to be applied to coastal resource management problems in Louisiana. Two major aspects of the research are: (1) the measurement of area of land (or emergent vegetation) and water and the length of the interface between land and water in TM imagery of selected coastal wetlands (sample marshes); and (2) the comparison of spatial patterns of land and water in the sample marshes of the imagery to that in marshes simulated by a computer model. In addition to activities in these two areas, the potential use of a published autocorrelation statistic is analyzed. Author

N86-31952# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

AUTOMATIC INTERPOLATION OF ISOLINES FROM AN IRREGULAR WATERLINE DIGITAL TERRAIN MODEL (DGM) THROUGH TRIANGULATION NETWORK [AUTOMATISCHE ABLEITUNG VON ISOLINIEN AUS EINEM UNREGELMAESSIGEN WASSERLINIEN-DGM UEBER DREIECKSVERMASCHUNG]

I. KRUSE *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 p 91-99 1985 In GERMAN; ENGLISH summary

Avail: NTIS HC A09/MF A01

A computer-based waterline procedure was extended to represent drying tidal flat area aerial photographs in digital and analog forms. The triangulation network transforms waterlines into isolines after data homogeneization. The procedure can be applied to process and represent digitized elevation lines. ESA

N86-31956# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

CALCULATION AND REPRESENTATIONS OF ELEVATION CHANGES IN A TIDAL FLAT AREA FROM DIGITAL TERRAIN MODELS [BERECHNUNG UND DARSTELLUNG VON HOEHENVERAENDERUNGEN IM WATT AUS DIGITALEN GELAENDEMODELLEN]

H. ROSENGARTEN *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 p 125-133 1985 In GERMAN; ENGLISH summary Original contains color illustrations

Avail: NTIS HC A09/MF A01

The tidal flat areas along the German North Sea coast subjected to large changes by the influence of tide and extreme meteorological conditions are studied to protect man against sea intrusions and hazards. The tidal flat areas are studied using electronic tachymetry, photogrammetry with water line procedures, hydrographic measurements and through aerial photograhy. The data are stored in a data bank and used to calculate elevation changes in tidal flat areas and improve the information on topographic maps. The cartographic representation of elevation changes is described. Map production through increased automation of the partial processes in map design and in reproduction can be economically applied. ESA

N86-32071# Royal Netherlands Meteorological Inst., De Bilt. Afdeling Fysische Meteorologie.

OBSERVATIONS OF SURFACE WATER TEMPERATURE IN THE NETHERLANDS FROM 1860: THE TEMPERATURE REGIME AND THE CHANGES IN IT

P. C. T. VANDERHOEVEN 1985 114 p In DUTCH; ENGLISH summary

(KNMI-WR-85-6; B8662754; ISSN-0169-1651; ETN-86-97731)

Avail: NTIS HC A06/MF A01

The results of different analyses of water temperature observations in the Netherlands covering 2500 station-years are presented. The winter water temperature was observed by IR satellite photos. The history of the station network is depicted. The water movements which are essential to understand the regime of water temperatures are discussed. The relation between all available 10 yr water temperature averages is described. Peculiarities of the annual water temperature are shown by Lissajous figures. Annual averages were analyzed by comparing their deviations with respect to the standard. ESA

N86-32072# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

A BISPECTRAL METHOD FOR THE HEIGHT DETERMINATION OF ICE CLOUDS

W. POLLINGER and P. WENDLING Dec. 1985 52 p In GERMAN; ENGLISH summary

(DFVLR-FB-86-03; ISSN-0171-1342; ETN-86-97586) Avail: NTIS HC A04/MF A01; DFVLR, Cologn, West Germany DM 36.50

A bispectral method for the height determination of optically thin ice clouds from satellite measurements at two adjacent points of an ice cloud layer was developed. Using 2 wavelengths in the spectral range of the water vapor band at 6.3 microns and in the window range at 11 microns, a transcendental equation was derived under the assumption that both points of the cloud have the same temperature but different optical thickness. The solution of the transcendental equation yields the cloud temperature, and the height via the temperature profile which must be known. The effect of the water vapor above the cloud is corrected for using a radiation transfer model. ESA

N86-32857# Dundee Univ. (Scotland). Dept. of Geology.

GRADIENTS OF CHANGE IN THE ESTUARINE ENVIRONMENTS OF THE TAY

J. MCMANUS *In* ESA Remote Sensing Applications in Civil Engineering p 143-149 Mar. 1985

Avail: NTIS HC A06/MF A01

The hydrology and structure of the Tay estuary (Scotland) were studied to assess remote sensing methods and technology. Results show that estuarine waters provide gradients of water surface, salinity, temperature and suspended sediment concentrations. Intertidal flats show systematic variations of grain size with coarse sands in channel margins and fine muds beside marshes. ESA

N86-32858# Norwegian Water Resources and Electricity Board, Oslo.

SNOW AND ICE

G. OESTREM *In* ESA Remote Sensing Applications in Civil Engineering p 151-163 Mar. 1985

Avail: NTIS HC A06/MF A01

A method which uses data from polar orbiting satellites to monitor snow cover in Norway was developed. Winter snow cover is of great economic importance in Norway because the meltwater accounts for a substantial part or annual inflow into reservoirs for hydroelectric power production(more than 99% of all electricity production). Snow surveys made by traditional methods are costly and labor intensive. Airborne gamma methods are also used, and a radio-echo method proves useful for glacier thickness measurements. A snow stick can be used for monitoring snowpack variations, and real-time data transmission can be made in the ARGOS system. General sea ice conditions can be reported by the NIMBUS microwave radiometer, whereas more detailed ice-edge mapping can be made from NOAA-IR data. ESA

N86-32871# Rijkswaterstaat, The Hague (Netherlands). Projectgroep Remote Sensing IJsselmeergebied.

REMOTE SENSING AND WATER QUALITY IN THE IJSSELMEER (NETHERLANDS) AREA [REMOTE SENSING EN WATERKWALITEIT IN HET IJSSELMEERGEBIED]

Jan. 1985 25 p In DUTCH

(MDLK-R-8537; ETN-86-97493) Avail: NTIS HC A02/MF A01

Possible contributions of Landsat multispectral scanner recording to the determination of a quantitatively spatial image of algae and silt, and relations between these and other parameters (e.g., transparence) were investigated. The relation between the feeding behavior of cormorants and RS observable differences of the water surface were examined as the birds seem to choose their feeding areas on the basis of optical water information. Valuable information concerning the spatial variation of optically observable matters and processes, e.g., chlorophyl, suspending dust, humus acids, transparence, temperature, and stream phenomena can be obtained. The results offer sufficient perspectives for further water quality investigations. ESA

07

DATA PROCESSING AND DISTRIBUTION SYSTEMS

Includes film processing, computer technology, satellite and aircraft hardware, and imagery.

A86-40824

INTERPRETATION OF MULTITEMPORAL LANDSAT MSS DATA USING SUPERVISED AND UNSUPERVISED METHODS

J. LICHTENEGGER (ESA, Frascati, Italy) and KL. SEIDEL (Zuerich, Eidgenoessische Technische Hochschule, Zurich, Switzerland) Photo Interpretation (ISSN 0031-8523), vol. 23, July-Aug. 1984, p. 21-24. In English, French, and Spanish. refs

The degree of accuracy and detail of multitemporal data sets using supervised classification methods for updating land use maps is examined for Landsat data of Grosses Moos, Switzerland, obtained throughout the 1976 growing season. A stepwise linear discrimination analysis supervised classification routine is performed, and all occurring land use categories were mapped. A ground truth control map was produced for selected large areas, and for the 14 different land use categories present in the area, comparison with monotemporal percentages showed a gain in accuracy. Principal component analysis was applied as a preprocessing step to create images for conventional visual interpretation. The complete area pixel aggregate is used to derive common principal components, and special principal components are calculated from the training sets used previously for supervised classification. R.R.

A86-40833* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

CHARACTERISTICS OF THE SIR-A SYSTEM AND IMAGES [CARACTERISTIQUES DU SYSTEME ET DES IMAGES SIR-A]

PH. REBILLARD (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) Photo Interpretation (ISSN 0031-8523), vol. 23, Jan.-Feb. 1984, p. 4-17, 19, 21 (18 ff.). In French, English, and Spanish.

Sample images obtained with the Shuttle Imaging Radar A (SIR-A) are presented, along with design and performance features of the SIR-A, Seasat and Landsat images of the same scenes for comparison purposes. The SIR-A functions at the L-band 25 cm at a frequency of 1278 GHz with a spectral bandwidth of 6 MHz. The images were taken at an angle of 47 deg and furnished a resolution of 40 m from an altitude of 259 km. The images covered a ground swath 50 km wide. The images are provided to assist in the development of effective techniques for interpreting radar imagery. The SIR-A instrument is a precursor of another imaging device which will be flown around Venus. The images provided include sections of France, Sardinia and Algeria. M.S.K.

A86-42016* Kansas Univ. Center for Research, Inc., Lawrence.

MAXIMUM LIKELIHOOD CLASSIFICATION OF SYNTHETIC APERTURE RADAR IMAGERY

V. S. FROST and L. S. YUROVSKY (University of Kansas Center for Research, Inc., Lawrence) Computer Vision, Graphics, and Image Processing (ISSN 0734-189X), vol. 32, Dec. 1985, p. 291-313. refs

(Contract NAGW-381)

Classification of synthetic aperture radar (SAR) images has important applications in geology, agriculture, and the military. A statistical model for SAR images is reviewed and a maximum likelihood classification algorithm developed for the classification of agricultural fields based on the model. It is first assumed that the target feature information is known a priori. The performance of the algorithm is then evaluated in terms of the probability of incorrect classification. A technique is also presented to extract the needed feature information from a SAR image; then both the feature extraction and the maximum likelihood classification algorithms are tested on a SEASAT-A SAR image. Author

A86-43963

ENHANCING LANDSAT DATA ACQUIRED UNDER VERY LOW ILLUMINATION

J. M. MILLER and G. J. BURGER (Alaska, University, Fairbanks) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, June 1986, p. 801-807. refs

The potential utility of MSS images with sun elevation-angles between minus 4 deg and plus 10 deg during the winters of 1984-85 and 1985-86 using Landsat-4 and -5 data acquired by the Alaskan Quick-Look system have been examined. When band 1 and band 2 sensors have been switched to the high-gain mode, it is shown that it is possible to delineate open leads in sea ice with a sun angle of minus 4 deg by stretching the 0 to 4 range of digital numbers to the full contrast of a photographic image. Land features can be imaged down to 0 deg, showing (snow covered) forests or brush contrasted with barren tundra. Dune deposits on the order of 20 feet in height are visible, and snow cover and ice characteristics on large lakes can be determined. It is concluded that one should not discount the value of Landsat data acquired with solar angles below 10 deg. Some natural features actually are enhanced by low incident-angles of illumination. Author

A86-43965* Alaska Univ., Fairbanks.

APPLICATION OF PHOTOGRAMMETRY TO THE STUDY OF VOLCANO-GLACIER INTERACTIONS ON MOUNT WRANGELL, ALASKA

C. S. BENSON (Alaska, University, Fairbanks) and A. B. FOLLETT (North Pacific Aerial Surveys, Inc., Anchorage, AK) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, June 1986, p. 813-827. Research supported by the Alaska Council on Science and Technology, Alaska Department of Natural Resources, National Park Service, Explorers Club of New York, and Arctic Institute of North America. refs (Contract NSF EAR-75-21506; NSF EAR-77-15166; NAG9-9)

Most Alaskan volcanoes are glacier covered and provide excellent opportunities to study interactions between glaciers and volcanoes. The present paper is concerned with such a study, taking into account the Mt. Wrangell (4317 m) which is the northernmost active volcano (solfatara activity) on the Pacific Rim (62 deg N; 144 deg W). While the first photographs on the summit of Mt. Wrangell were published more than 75 years ago, research there began in 1953 and 1954. Satellite images reveal activity at the summit of Mt. Wrangell. However, the resolution is not sufficient for conducting important measurements regarding ice volume losses. For this reason, vertical aerial photographs of the summit were obtained, and a field trip to the summit was conducted. Aspects of photogrammetry are discussed, taking into account questions of ground control, aerial photography, topographic mapping, digital cross sections, and orthophotos. G.R.

A86-44046

THE INFLUENCE OF GEOGRAPHY ON LOCAL ENVIRONMENT AS INFERRED FROM NIGHT THERMAL INFRARED IMAGERY

H. GOSSMANN (Freiburg, Universitaet, Freiburg im Breisgau, West Germany) Remote Sensing Reviews (ISSN 0275-7257), vol. 1, pt. 2, 1986, p. 249-275. refs

Results are presented from efforts by the Freiburg remote sensing group in processing and interpreting thermal IR images acquired by the Heat Capacity Mapping Mission (HCMM) spacecraft. Geometric corrections were applied to the images to obtain maps of the Federal Republic of Germany on a scale of 1:2 million, which were then enlarged to a scale of 1:200,000. The mesoscale images over mountainous terrain were detailed enough to discern cold valleys, warm slopes, and cold elevations. The distinctions were lost on higher resolution scales. Sample images are also discussed from forests, land-use and heat island (small villages) studies. The results support the realization of imaging systems with resolutions exceeding the 600 m resolution available with the HCMM. M.S.K.

A86-44050

HCMM SATELLITE DATA CALIBRATION AND ATMOSPHERIC CORRECTIONS

P. REINIGER (CEC, Joint Research Centre, Ispra, Italy) Remote Sensing Reviews (ISSN 0275-7257), vol. 1, pt. 2, 1986, p. 359-381. refs

Techniques developed for atmospheric corrections and calibration of the Heat Capacity Mapping Mission (HCMM) spacecraft thermal IR sensor are described. A radiative transfer equation was devised to account for atmospheric attenuation in terms of the temperature, vapor pressure and mass absorption coefficient. The WINDOW model was then defined to calibrate the surface temperature measured by the HCMM with the correction factor over the 10.5-12.5 microns interval. Correction factors were also obtained with ground truth data on grassland, a pine forest, and several water surfaces. Comparative data are provided from the NOAA-5 and TIROS-N sensors for the same areas. The correction factors followed the same trend for all the sensors. M.S.K.

A86-44154* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SIR-B - THE SECOND SHUTTLE IMAGING RADAR EXPERIMENT

J. CIMINO, C. ELACHI (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), and M. SETTLE (ARCO Oil and Gas Co., Plano, TX) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 445-452. NASA-supported research. refs

On October 5, 1984, the second Shuttle Imaging Radar (SIR-B) was launched into orbit aboard the Space Shuttle Challenger. SIR-B is part of an evolutionary radar program designed to progressively develop a multifrequency, multipolarization synthetic aperture radar with a variable earth-imaging geometry. The SIR-B instrument is an upgraded version of SIR-A, with the additional capability of tilting the antenna mechanically to acquire imagery at variable incidence angles ranging from 15 to 60 deg. The variable look angle capability provided a means of acquiring multiple incidence angle imagery over specific targets on successive days of the mission. These data are being used to classify surface features by their backscatter signatures as a function of incidence angle and for topographic mapping. In addition to the antenna tilt capability, a digital data-handling system was added to increase the dynamic range, the resolution was improved by a factor of two over SIR-A, and a calibration subsystem was added to improve the radiometric accuracy of the data. The mission had a number of problems, including loss of the primary digital data path between the Shuttle and the ground. In spite of these problems, approximately 20 percent of the planned digital data were collected over the 8-day Shuttle mission corresponding to an areal coverage of about 6.4 million sq km. Author

A86-44156*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AUTOMATED MATCHING OF PAIRS OF SIR-B IMAGES FOR ELEVATION MAPPING

H. K. RAMAPRIYAN, J. P. STRONG, C. W. MURRAY, JR. (NASA, Goddard Space Flight Center, Greenbelt, MD), and Y. HUNG (Maryland, University, College Park) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 462-472. refs

During the SIR-B mission in October 1984, a significant number of overlapping synthetic aperture radar (SAR) images of various ground areas was collected. This has offered the first opportunity to perform stereo analyses on images from space that cover large ground areas to determine elevation information. This paper presents the preliminary results of an investigation to obtain elevation data from stereo pairs of SIR-B images. First, the accuracy with which elevation information can be derived from SIR-B image pairs is evaluated theoretically. It is shown that elevation accuracy is a function of the slant range resolution, the incidence angles with which the stereo pair is obtained, the accuracies in spacecraft state estimation, and determination of corresponding pixels in the stereo pair. Next, a hierarchical method is developed to match the corresponding pixels. This method involves iterative removal of local distortions and correlations of pairs of local neighborhoods in the two images. Since it is necessary to perform the matching at every pixel in the image, it is very computationally intensive. Therefore, it has been implemented on the Massively Parallel Processor (MPP) at the Goddard Space Flight Center (GSFC). The MPP's speed permits two iterations of this technique to operate on a pair of 512 x 512 images within 7 s. Results of applying this algorithm of SIR-B images of Mount Shasta, CA, are shown. The matching algorithm performs well in regions of the image with significant features. An approximate elevation image derived from the matching process corresponds to published topographic map data, except for certain obvious discontinuities. Author

A86-44158* Vexcell Corp., Boulder, Colo.

MULTIPLE INCIDENCE ANGLE SIR-B EXPERIMENT OVER ARGENTINA STEREO-RADARGRAMMETRIC ANALYSIS

F. LEBERL, G. DOMIK (Vexcel Corp., Boulder, CO), J. RAGGAM (Graz, Technische Universitaet, Austria), J. CIMINO, and M. KOBRICK (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 482-491. refs

(Contract JPL-957363; NAS7-100)

Four overlapping Shuttle Imaging Radar-B (SIR-B) radar images were obtained across southern Argentina; these form a total of six stereo models with intersection angles ranging from 5 to 23 deg. This data set is uniquely suited for experimental evaluation of some basic assumptions on stereo-radargrammetry. Each stereo model was measured on a specially programmed photogrammetric analytical plotter; the resulting coordinates of ground points were compared with those from maps. It is concluded that accuracies are lower than expected at the larger stereo-intersection angles, amounting to about + or 60 m in each coordinate direction. This might be explained by limitations of the quality of stereofusion caused by look angle differences and specular point migration, backscatter differences due to different incidence angles, differences in azimuth directions, and image noise and speckle. Author

A86-44159* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

MULTIPLE INCIDENCE ANGLE SIR-B EXPERIMENT OVER ARGENTINA GENERATION OF SECONDARY IMAGE PRODUCTS

G. DOMIK, F. LEBERL (Vexcel Corp., Boulder, CO), and J. CIMINO (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 492-497. refs

(Contract JPL-957363; NAS7-100)

Original radar images may be geometrically and radio metrically distorted. This may be a particular problem when multiple angle imagery is analyzed and there is topographic relief in the area of interest. This paper describes a set of techniques designed to combine a multiple angle radar data set with a digital terrain elevation model, to generate a set of new images called secondary image products. These new images are geometrically rectified radar ortho-images radiometrically rectified images, and stereo ortho-images. These secondary images can then reliably be used for thematic interpretation. Author

A86-44173*# Geological Survey, Flagstaff, Ariz.

SHUTTLE IMAGING RADAR - PHYSICAL CONTROLS ON SIGNAL PENETRATION AND SUBSURFACE SCATTERING IN THE EASTERN SAHARA

G. G. SCHABER, J. F. MCCAULEY, C. S. BREED (USGS, Flagstaff, AZ), and G. R. OLHOEFT (USGS, Denver, CO) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 603-623. refs

(Contract NASA ORDER W-08760; NASA ORDER W-15788)

Interpretation of Shuttle Imaging Radar-A (SIR-A) images by McCauley et al. (1982) dramatically changed previous concepts of the role that fluvial processes have played over the past 10,000 to 30 million years in shaping this now extremely flat, featureless, and hyperarid landscape. In the present paper, the near-surface stratigraphy, the electrical properties of materials, and the types of radar interfaces found to be responsible for different classes of SIR-A tonal response are summarized. The dominant factors related to efficient microwave signal penetration into the sediment blanket include (1) favorable distribution of particle sizes, (2) extremely low moisture content and (3) reduced geometric scattering at the SIR-A frequency (1.3 GHz). The depth of signal penetration that results in a recorded backscatter, here called 'radar imaging depth', was documented in the field to be a maximum of 1.5 m, or 0.25 of the calculated 'skin depth', for the sediment blanket. Radar imaging depth is estimated to be between 2 and 3 m for active sand dune materials. Diverse permittivity interfaces and volume scatterers within the shallow subsurface are responsible for most of the observed backscatter not directly attributable to grazing outcrops. Calcium carbonate nodules and rhizoliths concentrated in sandy alluvium of Pleistocene age south of Safsaf oasis in south Egypt provide effective contrast in premittivity and thus act as volume scatterers that enhance SIR-A portrayal of younger inset stream channels. Author

A86-45196

MULTISPECTRAL DIGITAL IMAGE CLASSIFICATION BY THE SEPARATING HYPERPLANES METHOD [KLASSIFIZIERUNG MULTISPEKTRALER DIGITALBILDER MIT DER METHODE DER TRENNENDEN HYPERFLAECHEN]

S. L. EKENOBI (Lagos, University, Nigeria) Bildmessung und Luftbildwesen (ISSN 0006-2421), vol. 54, Jan. 1986, p. 23-29. In German. refs

The assumptiton of the Gaussian distribution for the classification data is a weakness of most land-use classification algorithms. This paper deals with a new algorithm which employs linear hyperplanes as discriminators, and does not assume any statistical properties for the classification data; hence the elimination of the situation which makes statistically stronger categories more important than the others in the classification process. Author

A86-45519

GROUND CONTROL AND THE SPOT MISSION [LES MOYENS SOL DE CONTROLE ET DE MISSION DE SPOT]

G. CALES (CNES, Toulouse, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 100, 1985, p. 27-31. In French.

SPOT satellite ground control stations are located near Toulouse, in Guiana, in South Africa and in Sweden. The links are maintained on the 2 GHz S band. Payload programming, stationkeeping and image processing functions are distributed among the various control stations, which are connected in real-time over telephone links. Two mainframe computers are dedicated to the control and payload programming functions and a third is in 1.2 million lines of FORTRAN code which are used for orbit control, stationkeeping and housekeeping, and observational functions. Nighttime operations at the control stations are generally devoted to receiving, recording, archiving and disseminating data gathered by the SPOT sensors during passages over sunlit regions. Daytime functions include selecting targets to view and preparing and issuing commands to the satellite. Observational sequences are usually prepared in a weekly format for transmission to the satellite. Block diagrams are provided for the command and control links of the ground control system. Author

A86-45520

SPOT RECEIVING STATIONS AND THE ASSOCIATED CENTERS FOR ARCHIVING AND PRETREATING DATA [LES STATIONS DE RECEPTION SPOT ET LES CENTRES D'ARCHIVAGE ET DE PRETRAITEMENTS ASSOCIES]

H. CARN (Societe Europeenne de Propulsion, Puteaux, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 100, 1985, p. 33-36. In French.

SPOT satellite data is transmitted at rates of 50 Mbit/sec to the growing ground receiving station network. Each station is or is being equipped to receive, store and treat the data to meet the quality specifications and client requirements. The ground stations use 9 m antennas for data reception on the 8 GHz band, with each receiving period lasting up to an hour. Received data are demodulated and synchronized, then stored on magnetic tape at a density of 6,250 bits/inch. A center for Image Rectification has the responsibilities of removing noise from the data, cataloging images acquired each day, correcting for radiometric and geometric distortions, and producing the requested images. Image correction procedures are automated to handle the 36 million points of each image. M.S.K.

A86-45521

THE ORGANIZATION OF THE SERVICE FOR DISSEMINATION OF SPOT IMAGES [ORGANISATION DU SERVICE DE DIFFUSION DES IMAGES SPOT]

G. BRACHET and A. FONTANEL (SPOT Image, S.A., Toulouse, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 100, 1985, p. 37-46. In French.

The SPOT organization is run as a private corporation which is in the process of establishing worldwide centers for marketing and providing the products of SPOT imaging activities. Ground data reception stations are being or have been constructed in several countries to provide real-time imagery of scenes covering the areas within 2500 km of the respective stations. Accords have thus far been signed with Canada, Bangladesh, India, China, and Saudi Arabia to establish stations in those countries. Two established stations are dedicated data archival stations, each handling 700 images (unprocessed) per day, treating 70 with level 1 corrections, and 10-20 images with geographic labeling. Block diagrams are furnished of the SPOT organizational network for receiving, recording, archiving, treating, marketing and disseminating the SPOT images, and for accessing the organization to learn of the services that are available and acquiring imagery. The imagery can either comprise processed images produced in a photographic form or can include information which is not part of the SPOT system per se. M.S.K.

A86-45522

SPOT TERMINOLOGY [LA TERMINOLOGIE SPOT]

R. ZAHARIA (CNES, Division Sciences de la Terre et Applications, Paris, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 100, 1985, p. 49-57. In French and English.

A glossary of significant terms has been developed in order to facilitate the use of SPOT imaging capabilities by commercial markets. The glossary provides acronyms and terms in both french and english, and communicates the performance and instrumental capabilities of the SPOT sensors and their applications. Nearly 50 annotated terms and definitions are presented, representing an Oct.30, 1985 update. A Committee has been established for periodically reviewing the contents and issuing revisions. The entire existing Glossary is provided. M.S.K.

A86-45523

THE SPECIFICATIONS AND IN-FLIGHT VERIFICATION OF THE CHARACTERISTICS OF SPOT IMAGES [SPECIFICATIONS ET VERIFICATION EN VOL DES CARACTERISTIQUES DES IMAGES SPOT]

G. BEGNI (CNES, Toulouse, France), R. ZAHARIA (CNES, Paris, France), and J. DEFER Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 100, 1985, p. 59-66. In French. refs

The analytical forms and procedures employed for in-flight calibration of the SPOT sensors to ensure that the images met predefined radiometric (RQ) and geometric quality (GQ) criteria are summarized. The RQ was defined on the basis of the capability of faithfully reproducing the measured radiances. The recorded spectra were analytically compared to reference spectra for the various scenes. Account was taken of the noise components of any given scene, the possibilities of error introduced by the processing algorithms (which assumed gaussian distributions for the spectra), and the cumulative effects of noise on the imagery. A solar sensor was used for comparative calibration of the spectral measurements. Various GQ geometric specifications were built and programmed into the equipment, including 0.1 pixel resolution. Calibration efforts included determination of the positioning accuracy relative to the orbital altitude, the spacecraft attitude, the sensor timing and image time labeling. GQ calibration consisted of identifying scene pixel locations to within 500 m, establishing the scene object length mesurements to within 0.001 in two perpendicular directions, comparing and reconciling signals from different spectral bands from the same scene, and verifying the algorithms for quantifying the within-scene altimetric relief. M.S.K.

A86-45524

POTENTIAL APPLICATIONS OF SPOT IMAGERY FOR TOPOGRAPHIC AND NUMERICAL CARTOGRAPHY [LE POTENTIEL DES IMAGES SPOT POUR LA CARTOGRAPHIE TOPOGRAPHIQUE ET NUMERIQUE]

A. BAUDOIN (Institut Geographique National, Saint-Mande, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 100, 1985, p. 67-78. In French. refs

Much of the surface of the earth has either not been mapped or has been mapped at scales of 1:250,000 or higher. The SPOT satellite, with a monochromatic imaging capability of 10 m resolution, can provide maps at scales of 1:100,000 and sufficient data to improve existing maps to resolutions of 1:50,000 or 1:100,000. SPOT images are similar in detail to those available from medium resolution airborne photography, which can supply control point images for generating medium scale maps using SPOT images. These in turn are processed to obtain photographic results that can be interpolated into maps that could include topographic and land use data, roads, and vegetal categorization. Existing maps can be revised and augmented to encompass such information as industrial zones, power lines, land use categories, etc. These applications, because of the periodicity of SPOT passage over the same points of the earth, are of interest due to the frequent opportunities to update the resulting data for a given area, as well as the capability to store, analyze and manipulate the data numerically. M.S.K.

A86-45525

EVOLUTION OF THE SPOT SYSTEM BEYOND 1990 - SPOT 3 AND 4 [EVOLUTION DU SYSTEME SPOT AU-DELA DE 1990 - SPOT 3 ET 4]

M. TRAIZET (CNES, Paris, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 100, 1985, p. 87-89. In French.

A decision, announced in 1985, has been made to pursue development of SPOT 3 and 4 spacecraft as successors to the SPOT 1 and 2 spacecraft of the 1980s. The efforts are in part spurred by a recent surge in the number of countries with remote sensing programs and the number of earth stations with the capabilities of receiving and processing satellite imagery. The SPOT imagery market could benefit from users who wish access to a continuity of imagery, and by markets which periodically require imagery, such as for crop or land use monitoring. The agricultural markets are expected to show the greatest increase in demand. The improvements intended for the SPOT 3 and 4 spacecraft include lifetimes of 4 yr each, compared to 2 yr lifetimes of SPOT 1 and 2 spacecraft. A specialized sensor will be developed for vegetation mapping with a 100 deg field of view and a resolution of 1 km. The orbit of the new SPOT satellites, the first to be launched at the end of 1990, will allow new imagery of selected areas every 3-4 days. M.S.K.

A86-46059

COMPAR - A COMPUTERIZED TECHNIQUE FOR THE IN-DEPTH COMPARISON OF REMOTELY SENSED DATA

R. G. CONGALTON and A. M. B. REKAS (U.S. Army, Engineer Waterways Experiment Station, Vicksburg, MS) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 98-106. refs

A U.S. Army Engineer Waterways Experiment Station (WES) automated procedure, COMPAR, is developed for the detailed comparison of remotely sensed data with a corresponding verified reference data set. The input data consists of a geometrically uncorrected classified image, control points that are identifiable on both the image and the standard map, and the standard data set in a square grid array format. The full information content of the image data is preserved for classification purposes by performing the resampling of the image data to the grid size and geographic positioning of the standard, after the image is classified. The WES comparison method produces standard error matrices, an accuracy matrix, a reliability matrix, and a distribution matrix. The class, shape, and number of grids for each polygon on the standard map are compared to the actual number of grids falling into each class for the corresponding polygon in the classsified image. R.R.

A86-46071

ORTHOPHOTOMAPPING PRODUCTION WITH AN AUTOMATIC SYSTEM AT 1/5000 MAP SCALE

ALBERICH (Catalunya, Institut Cartografic, Barcelona, Spain) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 222-228.

A high-production four-year orthophotomapping project over a large area and at 1/5000 map scale is described. Flight lines used an 80 percent longitudinal and 45 percent lateral overlap, and the 1/22000 photo scale was found to be optimum. A more dedicated flight has allowed the reduction in cost of the editing process, and use of the Wild ACI analytical plotter for aerotriangulation has eliminated preparation for the orthophoto process. After the absolute orientation epipolar lines of the stereo pair are computed, and approximate matched areas are scanned parallelly to the base line, the Gestalt-IV photomapper system is applied to determine horizontal parallels which are used to rectify the photoimage. The use of the automatic on-line correlation procedure has minimized the time spent on collecting height data. R.R.

A86-46077

STEREO IMAGE TRANSFER SYSTEM WITH FAST DIGITAL VIDEO PROCESSORS AND MERGED GRAPHICS DISPLAY

R. R. REAL and Y. FUJIMOTO (National Research Council of Canada, Div. of Physics, Ottawa) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 272-283. refs

A stereo video image system under development is described for measurement, interpretation and other operations upon static or dynamic 3-D scenes or their photographic representation. Image processing algorithms to be implemented are real-time spatial filtering, histogramming, correlation, image matching and intensity feature estimation. These are to be merged with a display system that supports graphics, alphanumerics and color. Trends in fast digital image processors are also discussed. Author

A86-46102

COMPARISON OF CUBIC-CONVOLUTION INTERPOLATION AND LEAST-SQUARES RESTORATION FOR RESAMPLING LANDSAT MSS IMAGERY

L. S. KALMAN (Technicolor Government Services, Inc., Sioux Falls, SD) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 546-556. refs
(Contract USGS-14-08-0001-20129)

Two methods for resampling Landsat MSS data, cubic-convolution interpolation and least-squares restoration, are analyzed. The geometrical registering and resampling of Landsat MSS images from the Washington, D.C. area and Needles, CA, using the two methods are described. The methods are compared in terms of pixel values, frequency content, image statistics, and visual clarity. It is observed that the restoration method provides sharper images with greater information content than the cubic-convolution interpolation. I.F.

A86-46103

AN EVALUATION OF A NEW STATISTICAL APPROACH TO TRADITIONAL LINEAR DESTRIPING

M. E. RICHARDS (Technicolor Government Services, Inc., Sioux Falls, SD) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 557-563.
(Contract USGS-14-08-0001-20129)

Multiple-detector scanning systems exhibit striping patterns caused by non-uniform calibration and the analog to digital quantization process. Traditional linear destriping is the adjustment of detector gain and bias with values computed from the individual mean and standard deviation detector statistics and the same statistics for the entire image. A newly proposed statistical approach to destriping retains the floating point values from the linear function and incorporates a two-dimensional randomly generated binary table to control the conversion from floating point to integer values, rather than using a traditional truncation conversion method. Landsat multispectral scanner (MSS) data acquired on June 2, 1973, were processed with both the traditional and the statistical destriping techniques. The traditional linear destriping did not suppress striping completely, since it applied the same destriping matching function to a given detector input value. The statistical approach was more successful at attenuating striping as it changed the output pixel value from applying of the destriping function, according to the probability of its fractional part. Author

A86-46107

MAXIMIZING COLOR CONTRAST AND REALISM IN COLOR PLOTTER RENDITIONS OF LANDSAT DIGITAL IMAGERY

D. L. PLONDKE (Cities Service Oil and Gas Corp., Tulsa, OK) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 637-641.

A86-46109

ON THE ANALYSIS OF AERIAL SCENES

C. A. HARLOW, R. W. CONNERS, R. VASQUEZ-ESPINOSA, and C. NG (Louisiana State University, Baton Rouge) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 651-660. refs
(Contract DAAG23-82-K-0189)

A hierarchical computer vision system which utilizes models of objects that may appear in the aerial scene is investigated. These objects are generic objects that may appear at any level of detail or resolution in the scene and are the nodes in the hierarchical representation of the scene. The existence of operators to extract image cues for nodes at any level in the hierarchy enables one to have a data driven system as opposed to a top-down or bottom-up analysis system. A substantial effort has been directed toward defining operators and system has been developed for defining measures which characterize perceptual properties. Preliminary investigations on aerial scenes indicate the system is useful in characterizing patterns that appear in aerial scenes. Author

A86-46113

SCALE DETERMINATION ON VERTICAL AERIAL PHOTOGRAPHS

J. J. ULLIMAN (Idaho, University, Moscow) and M. L. HOPPUS (Lockheed Image Analysis Laboratory, Las Vegas, NV) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 689-698. refs

Two methods for determining scale on vertical aerial photographs are suggested in lieu of common practices. For mountainous terrain, the use of 'point scale' (i.e., the exact scale at a particular elevation) which is derived using the aircraft altitude variable rather than 'line scale' or 'average scale', which is normally determined by measuring a photo and map distance, is proposed. A 'photo distance ratio' method of determining scale especially for large photo scales, special project work, and where there are no maps available is presented. Author

A86-46115

SYSTEM CALIBRATION AND SELF-CALIBRATION WITH FULL-CONTROLLED VERTICAL AERIAL PHOTOGRAPHY

H. ZIEMANN (National Research Council of Canada, Div. of Physics, Ottawa) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 736-745.

Six small blocks of vertical aerial photographs taken with two different cameras simultaneously over three different testfields were used to perform first a system calibration and then several self-calibrations using different sets of parameters in a bundle adjustment program. The investigation points to differences in the effectiveness of the used self-calibration parameter sets in regard to their ability to handle image deformation and image distortion. Author

A86-46120

THE DIGITIZATION AND MACHINE PROCESSING OF AERIAL PHOTOGRAPHY TO FACILITATE DETECTION OF CHANGES IN ISLAND LOCATIONS AND SIDE CHANNELS

A. J. BRUZEWICZ (U.S. Army, Planning Div., Rock Island, IL) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 803-808.

A86-46477

A SIMPLE BIDIRECTIONAL REFLECTANCE MODEL FOR TERRESTRIAL SURFACES

B. PINTY and D. RAMOND (Clermont-Ferrand II, Universite; Observatoire de Physique du Globe, Aubiere, France) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, June 20, 1986, p. 7803-7808. refs

A simple bidirectional reflectance model is derived for terrestrial surfaces. This model uses photometric relationships together with data from the Nimbus 7 Earth Radiation Budget (ERB) Experiment. It is shown that the model provides a good description of bidirectional patterns derived from satellite observations for two classes of broad uniform surfaces, namely, land and desert. The dependence of the derived albedo model on solar zenith angle is also studied and compared with several observations made at the surface of the earth. Despite the simplicity of the approach, the proposed bidirectional reflectance model might be useful for several applications in satellite remote sensing. Author

A86-46607

BAND-LIMITED GLOBAL SCALAR MAGNETIC ANOMALY MAP OF THE EARTH DERIVED FROM MAGSAT DATA

J. ARKANI-HAMED and D. W. STRANGWAY (Toronto, University, Ontario, Canada) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, July 10, 1986, p. 8193-8203. NSERC-supported research. refs

The magnetometer satellite (Magsat) data are separated into two distinct sets: the dawn and the dusk sets. The two sets are analyzed independently because of the dawn-dusk asymmetry of the external magnetic field components of the data. Two scalar magnetic anomaly maps, the dawn and the dusk maps, are derived using the spherical harmonic expressions of the respective data set. The significant correlation of the two maps in the harmonic range of 18-41 indicates the repeatability of the Magsat data in these harmonics. The shortest repeatable wavelength is about 920 km. A band-limited global scalar magnetic anomaly map is derived at about 410 km altitude by arithmetic averaging of the dawn and the dusk maps. The map is then downward continued to about 10 km altitude. The downward continued magnetic anomalies are relatively more localized. The main features of the anomalies are as follows: (1) Continents have relatively stronger magnetic anomalies than oceans, especially the younger oceans, (2) many circum-Pacific subduction zones have magnetic signatures, and (3) there is no overall correlation between anomalies and major shields. Author

A86-46718

IMAGE QUALITY: AN OVERVIEW; PROCEEDINGS OF THE MEETING, ARLINGTON, VA, APRIL 9, 10, 1985

E. M. GRANGER, ED. (Eastman Kodak Co., Rochester, NY) and L. R. BAKER, ED. (Sira, Ltd., Chislehurst, England) Meeting sponsored by SPIE and Sira, Ltd. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 549), 1985, 172 p. For individual items see A86-46719 to A86-46725.

(SPIE-549)

Various papers on image quality are presented. The subjects discussed include: image quality considerations in transform coding, psychophysical approach to image quality, a decision theory approach to tone reproduction, Fourier analysis of image raggedness, lens performance assessment by image quality criteria, results of preliminary work on objective MRTD measurement, resolution requirements for binarization of line art, and problems of the visual display in flight simulation. Also addressed are: emittance in thermal imaging applications, optical performance requirements for thermal imaging lenses, dynamic motion measurement using digital TV speckle interferometry, quality assurance for borescopes, versatile projector test device, operational MTF for Landsat Thematic Mapper, operational use of color perception to enhance satellite image quality, theoretical bases and measurement of the MTF of integrated image sensors, measurement of the MTF of thermal and other video systems, and underflight calibration of the Landsat Thematic Mapper. C.D.

A86-46725

UNDERFLIGHT CALIBRATION OF THE LANDSAT THEMATIC MAPPER

J. R. SCHOTT (Rochester Institute of Technology, NY) IN: Image quality: An overview; Proceedings of the Meeting, Arlington, VA, April 9, 10, 1985 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1985, p. 157-161. refs

An approach for evaluation of the Radiometric Quality of Landsat 4/5 Thematic Mapper Band 6 data is presented. The approach involves comparison of measured surface temperature with surface temperature predicted from observed satellite radiances propagated to the ground using the LOWTRAN 5A model. The atmospheric propagation data and surface temperatures are also compared with atmospheric propagation measurements and surface temperatures measured during an aircraft underlight of the satellite. Author

A86-46727

ADVANCES IN LANDSAT IMAGE PROCESSING AND MAPPING

R. BERNSTEIN and W. A. HANSON (IBM Palo Alto Scientific Center, CA) IN: Sensor design using computer tools II; Proceedings of the Meeting, Arlington, VA, April 11, 12, 1985 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1985, p. 12-23. refs

A Landsat image processing procedure and a system for its implementation have been developed in order to iteratively correct the geometry of image data and to merge the data with auxiliary graphical data. The system allows for both the manual selection of ground control points that establish the geometric correction parameters, and for an automatic determination of mapping parameters on the basis of operator definition of the desired cartographic location. Attention is given to the results of experiments conducted with such data sources as Landsat Thematic Mapper data, geophysical gravity data, and digital line graph cartographic data. O.C.

A86-47840#

ON THE IMPROVEMENT OF SAR IMAGE INTERPRETABILITY USING SPECTRAL MULTI-LOOKING AND SPATIAL FILTERING

T. HIROSE and J. HARRIS (F.G. Bercha and Associates, Ltd., Ottawa, Canada) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 601-617. Research supported by the RADARSAT Project Office. refs

Although synthetic aperture radar (SAR) data has been shown to provide information for both reconnaisance and detailed geologic mapping, inherent speckle noise has been reported to detract from its interpretability. Two common techniques used to reduce speckle are multi-looking of the complex signal and spatial filtering. The first purpose of this study is to investigate the effect of combining these techniques for improving image interpretability. One and four look simulated target models and real Seasat SAR imagery have been spatially filtered with varying window sizes. A pairwise test is performed on both datasets in addition to geological interpretation of the Seasat data to obtain qualitative results. Secondly, the affect of image scale on image preference is evaluated using three sets of scales for one and four look Seasat data. Results indicate that the preferred imagery depends on the target type, and spatial filtering of the original SAR data marginally improves interpretability. Moreover, scale is shown to play a role in image preference. Author

A86-47913#

AN ALGORITHM FOR THE COMPUTATION OF COVERAGE AREA BY EARTH OBSERVING SATELLITES

E. HAYES (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) IN: Astrodynamics Conference, Williamsburg, VA, August 18-20, 1986, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1986, p. 121-126.
(AIAA PAPER 86-2067)

This paper describes an algorithm which was developed to compute earth coverage area as seen by a constellation of satellites. Coverage is a parameter by which the efficiency and robustness of a constellation may be evaluated, and is an important mission requirement of many space systems. The algorithm for the computation of exact coverage area is based upon set theory, vector operations, and spherical trigonometry. The position of a satellite may be completely defined by a position vector and the coverage circle radius is a function of satellite altitude. Therefore, given that the angle of the field of view is known, complete information on the location and size of a coverage circle is contained in a single position vector. Author

A86-48954

NOAA AVHRR IMAGE REFERENCING

D. HO and A. ASEM (IBM France, S.A., France) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, July 1986, p. 895-904. refs

A simple and fast algorithm for image referencing of NOAA AVHRR (Advanced Very High Resolution Radiometer) data has been derived to facilitate the identification of geographic coordinates corresponding to any pixel on an NOAA image and vice versa. The procedure assumes a spherical earth and circular orbit and takes into account the effects due to the earth's rotation and oblateness and the scan skew. Inputs to the procedure are the ascending nodal longitude and time, the time of the first scan line and one ground control point (GCP). The effects of an ellipsoid earth and an elliptical orbit are corrected by using the GCP to adjust the spacecraft altitude and inclination angle. No detailed emphemeris data are required. The average rms errors, obtained by comparison with independent sets of well-distributed GCPs for each image, are about 2 pixels and 2 lines or 3 km displacement. Results from the procedure are illustrated by the rectification of NOAA images over France. Author

A86-49601#

REMOTE SENSING DATA AS BASIS OF SYNTHETIC BIOCLIMATIC MAPS [FERNERKUNDUNGSDATEN ALS GRUNDLAGE VON SYNTHETISCHEN BIOKLIMAKARTEN]

G. MENZ and M. SCHEER (Freiburg, Universitaet, Freiburg im Breisgau, West Germany) BMFT, Statusseminar ueber die Nutzung von Fernerkundungsdaten in der Bundesrepublik Deutschland, Garmisch-Partenkirchen, West Germany, Jan. 20-22, 1986, Paper. 12 p. In German. refs

The synthetic bioclimatic maps, obtained as a result of bioclimatic analyses and evaluations, can now be very significantly improved with the aid of a new method. This method utilizes as a basis remote sensing data and digital supplementary data. The achieved improvement is related to an enhancement of the accuracy of the computed bioclimatic values and considerations of availability. Possibilities and limitations regarding an application of satellite data in bioclimatic problems are discussed, taking into account the characteristics of a number of satellites which are suited for applications in climatology. Attention is given to aspects of data management in a geographical information system (GIS), relations between the heat production of the human body and climatological parameters, thermal climatological relations for a section in the southwest of Germany, and land use and altitude data. G.R.

A86-49610#

RESULTS OF THE PRACTICAL APPLICATION OF REMOTE SENSING IN THE FEDERAL INSTITUTE FOR EARTH SCIENCES AND RAW MATERIALS [ERGEBNISSE PRAKTISCHER ANWENDUNG DER FERNERKUNDUNG IN DER BUNDESANSTALT FUER GEOWISSENSCHAFTEN UND ROHSTOFFE /BGR/]

D. BANNERT (Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hanover, West Germany) BMFT, Statusseminar ueber die Nutzung von Fernerkundungsdaten in der Bundesrepublic Deutschland, Garmisch-Partenkirchen, West Germany, Jan. 20-22, 1986, Paper. 9 p. In German. refs

The institute considered in the present paper, which, according to its German name, has the acronym BGR, is concerned with the evaluation of aerial photographs, and the acquisition, production, and evaluation of satellite imagery. In addition, the institute provides advice in matters related to the acquisition and utilization of remote sensing data, and conducts investigations regarding the possibility to use remote sensing data, in particular, satellite data. In a number of different areas of the earth, the BGR performs studies with respect to the occurrence of mineral and hydrocarbon deposits, the presence of groundwater, and the optimization of soil utilization. A number of examples are selected with the objective to illustrate the nature of the work conducted by the BGR. The areas involved are located in arid, semiarid, and humid tropical regions. The reported projects are based on the utilization of Landsat-Multispectral-Scanner (MSS) and Thematic Mapper (TM) data. G.R.

A86-49722

ORDERING OF TIME-DIFFERENCE DATA FROM MULTISPECTRAL IMAGERY

P. SWITZER and S. E. INGEBRITSEN (Stanford University, CA) Remote Sensing of Environment (ISSN 0034-4257), vol. 20, Aug. 1986, p. 85-94. refs
(Contract NSF MCS-81-09584)

The goal of this investigation is to exhibit multispectral time-difference data in factored form so as to emphasize signal differences, assumed to be spatially structured, and isolate noise, which is assumed to be spatially unstructured. The method used is a variant of the MAF procedure (min/max autocorrelation factors), a general purpose technique which extracts p orthogonal linear combinations or factors of the p-variate data which have maximal to minimal spatial autocorrelation. The application of MAF to time-difference imagery is discussed, and three examples are presented. The first two examples were generated from Landsat MSS image pairs and the third from Daedalus airborne scanner imagery. Author

A86-50236
MOCA - AN INTERACTIVE SYSTEM FOR DATA INTEGRATION AND DECISION ASSISTANCE [MOCA - UN SYSTEME INTERACTIF D'INTEGRATION DES DONNEES ET D'AIDE A LA DECISION]
T.-T. CAO and M. HUMBERT (Bureau de Recherches Geologiques et Minieres, Orleans, France) Metropolis (ISSN 0224-1250), no. 70-71, 4th Quarter, 1985, p. 82-88. In French. refs

A cartographic modeling program (MOCA) written in Assembler is presented for quasi-expert analysis of topographical maps generated with multispectral remote sensing imagery. The program was developed to assist in land use planning, and is designed to aid in decisions on the development of image areas on the bases of the lithology, water drainage, and topography of scenes scanned. The data in the MOCA images permit engineers and developers to identify suitable regions for various types of development, e.g., commercial, industrial, residential, etc. MOCA permits queries as to the feasibility of specific types of development in a given subregion. The type of development and area are indicated and MOCA ranks the choice on a scale from poor to excellent for the type of development considered. The program is currently confined to use with images that have already been thematically mapped. M.S.K.

N86-28488# European Space Agency, Paris (France).
PROCEEDINGS OF A WORKSHOP ON THEMATIC APPLICATIONS OF SAR DATA
D. GUYENNE, comp. and O. MELITA, comp. Dec. 1985 106 p
Workshop held in Frascati, Italy, 9-11 Sep. 1985
(ESA-SP-257; ISSN-0379-6566; ESA-86-96853) Avail: NTIS HC A06/MF A01

Applications of SAR data to agriculture, forestry, ice reporting, snow monitoring, and geological surveys were discussed. ESA

N86-28489# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
SELECTED APPROACHES TO THEMATIC SAR STUDIES
J. P. GUIGNARD *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data p 5-6 Dec. 1985
Avail: NTIS HC A06/MF A01

Studies aimed at establishing what SAR system parameters (e.g., frequency, angle of incidence, polarization) are most suited to thematic applications are introduced. Studies aimed at defining optimal information extraction schemes by assessing the statistical properties of required parameters and developing decision tools (e.g., Bayes estimators, maximum likelihood estimators) for automatic derivation of quantitative values related to geophysical phenomena, from SAR images are outlined. Studies of analysis tools of interest for any application, such as radargrammetry (correction of the geometry of the SAR images) and extraction of land features (e.g., roads, buildings) are discussed. ESA

N86-28496# Technische Univ., Graz (Austria). Inst. for Image Processing and Computer Graphics.
RADARGRAMMETRIC ASPECTS OF SAR DATA EVALUATION
J. RAGGAM, G. TRIEBNIG, M. F. BUCHROITHNER, G. DOMIK (Vexcell Corp., Boulder, Colo.), and F. W. LEBERL *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data p 57-64 Dec. 1985
Avail: NTIS HC A06/MF A01

Radargrammetric image analysis is discussed, emphasizing applicability for geology and land snow and ice mapping. The results of these application studies lead to conclusions for radar satellite missions. A method to create digital elevation models from radar stereo-images is outlined. Radar stereo viewability is considered. ESA

N86-28802# National Weather Service, Salt Lake City, Utah.
RADID (RADAR DISPLAY DEVICE) INTERPRETATION GUIDELINES
R. G. PAPPAS Mar. 1986 35 p
(PB86-177680; NOAA-TM-NWS-WR-195) Avail: NTIS HC A03/MF A01 CSCL 04B

Interpretative guidelines for users of radar remoting systems are given. The focus is upon the benefits and inherent limitations of this approach to weather radar data communication and display, and radar interpretation, particularly unique problems in the Western United States. This set of guidelines applies principally to Radar Display Device (RADID) displays but will also be useful for Radar Remote Weather Display System (RRWDS) and commercial color radar remote users. RRWDS consists of two primary components - a digitizer on a radar for generating VIP-level data and a display system which includes a separate processor. RADID is a display device only. RADID can access data from RRWDS and commercial digitizers. RRWDS displays can only access data from RRWDS digitizers. GRA

N86-29181 Technische Univ., Hanover (West Germany).
INVESTIGATIONS OF SYSTEMATIC IMAGE DEFECTS NOT TAKEN INTO ACCOUNT IN AEROTRIANGULATION [UNTERSUCHUNG NICHT BERUECKSICHTIGTER SYSTEMATISCHER BILDFEHLER BEI AEROTRIANGULATIONEN]
K. JACOBSEN *In* Deutsche Geodaetische Kommission Camera Calibration in Photogrammetric Practice p 65-71 1985 In GERMAN
Avail: Issuing Activity

The procedures for investigation of residual systematic image defects in calculation of the residue mean values and in covariance analysis of block adjustment with or without self-calibration are described. The investigations are performed on a computer system with programs for bundle block adjustment. The differences between the mathematical model of central perspective and film geometry are due to self-calibration of additional parameters in a bundle block adjustment. ESA

N86-29202# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
IMAGE DATA COMPRESSION WITH SPLINE APPROXIMATION AND SEGMENTATION
J. J. RENES and P. J. DEPAGTER 24 Apr. 1984 12 p Presented at Benelux Information Theory Conference, Aalten, Netherlands, 24-25 May 1985
(Contract NIVR-1874)
(NLR-MP-84043-U; B8660422; ETN-86-97505; AD-B098996L)
Avail: NTIS HC A02/MF A01

An image data compression algorithm based on spline approximation and image segmentation is described. Coding of segmented images is outlined. An image produced by a CDC Cyber 170-855 system is shown. ESA

N86-29287*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, N.Y.
ISCCP REDUCED RESOLUTION SATELLITE RADIANCE DATA
W. ROSSOW *In* NASA. Goddard Space Flight Center Proceedings of the Second Pilot Climate Data System Workshop 23 p 1986
Avail: NTIS HC A12/MF A01 CSCL 04B

The International Satellite Cloud Climatology Project (ISCCP) is the first active project of the World Climate Research Program. It is a multinational data collection project focused on collecting a data set that will improve the ability to predict and/or simulate the radiative effects of clouds on climate. For specified cloud parameters, the goals are to archieve values for 3-hour periods over the whole globe for 5 years at 30 km resolution. The task of collecting and processing radiance data from both geosynchronous and polar orbiting satellites began in July 1983. A diagram was shown illustrating the flow of data from the transmitting satellites to the various receiving institutions that handle it. The various stages of processing were then explained in detail, emphasizing

Level B3-normalized, reformatted, reduced raw satellite data. The reduction of data by sampling is an essential step in the flow. By the time the ISCCP data reaches the Global Processing Center at Goddard Institute for Space Studies (GISS), the volume has been reduced by a factor of 1000. The Pilot Climate Data System (PLDS) will provide access to the ISCCP data set. It should prove to be one of the cleanest satellite data sets because it will have been through three filters--that of the operational agency, the Global Processing Center, and the PCDS. The ISCCP data set also includes other correlative data sets delivered in compatible format. Author

N86-30246# Army Engineer Topographic Labs., Fort Belvoir, Va.

IMPLEMENTATION OF MAP-TO-IMAGE-CORRESPONDENCE FOR SYNTHETIC APERTURE RADAR IMAGE ANALYSIS

G. E. LUKES and J. H. RAGGAM 1985 11 p
(AD-A166791; ETL-R-082) Avail: NTIS HC A02/MF A01 CSCL 08B

Radargrammetric techniques, developed to support stereo mensuration and data capture from synthetic aperture radar (SAR) imagery, have been extended to enable map-to-image correspondence for computer-assisted radar image analysis. This mechanism projects existing digital map data into the image space of a new SAR image rigorously accounting for the sensor imaging geometry and terrain configuration. Prerequisites for SAR map-to-image correspondence include (1) an analytical sensor model, (2) recovery of the image acquisition parameters and (3) three-dimensional (3d) digital map data. Analytical radar mapping techniques address the first two issues. Suitable 3d planimetric map data can be compiled directly from stereo photography using analytical plotters or indirectly using elevation data interpolated from digital elevation models to augment conventional two-dimensional map data derived from manuscripts. The approach is illustrated by selected examples from a case study conducted for a test area near Frieburg, West Germany. Here, 3d digital data for transportation and landcover maps were assembled from cartographic sources using plan metric augmentation. GRA

N86-31096# Argonne National Lab., Ill.

DISTRIBUTED GEOGRAPHIC MAPPING USING A CENTRALIZED DISSPLA-BASED MAPPING SYSTEM AND AUTOCAD PC SOFTWARE

M. SNIDER 1986 7 p Presented at the ISSCO Week, New Orleans, La., 10 Mar. 1986
(Contract W-31-109-ENG 38)
(DE86-009184; CONF-860363-2) Avail: NTIS HC A02/MF A01

This paper describes procedures devised for transferring mapped information between a DISSPLA-based geographic mapping system on a centralized computer and an AUTOCAD system on a PC. The centralized mapping system is used as a repository for the large map data bases and to provide capabilities for drawing maps on various output devices including graphics terminals. The map data from any map drawn on the centralized system can be down-loaded to the PC. AUTOCAD is then used to view and edit the map and to add information. Final maps can be drawn using the AUTOCAD software or the AUTOCAD files can be sent to the centralized system to be included in the central data bases. These procedures allow us to take advantage of DISSPLA software, data management facilities, and graphical analytic functions available on the central system, while using the more interactive features available in AUTOCAD for viewing, entering, and editing the data. DOE

N86-31957# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

BRIEF REPORT ON DESIGN AND IMPLEMENTATION OF A DATA BANK CORE SYSTEM [KURZBERICH UEBER ENTWURF UND IMPLEMENTIERUNG EINES DATENBANKKERNSYSTEMS]

H. J. SCHEK *In its* Reports on Cartography and Geodesy. Series 1: Original reports, No. 95 p 135-141 1985 In GERMAN; ENGLISH summary
Avail: NTIS HC A09/MF A01

The applicability of a modular data bank system to digital geoscientific mapping is studied. The data bank components forming the cartography interface basis have a layered architecture. The architecture of a geodatabank core system consists of a catalog manager, a geodata manager, data recovery, a version manager, a complex record manager, a permanent storage unit and a buffer. The modular data bank core system can be used for geoscientific applications. ESA

N86-31961# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

THREE-DIMENSIONAL VIEWS OF CARTOGRAMS IN DIGITAL RASTER MODE [SCHEINPLASTISCHE DARSTELLUNGEN VON KARTOGRAMMEN IN DIGITALEN RASTERMODUS]

W. WEBER *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 p 175-189 1985 In GERMAN; ENGLISH summary
Avail: NTIS HC A09/MF A01

A digital raster method for producing three-dimensional views of cartograms (choropleth maps) and layered maps of real or thematic mountainous regions (continuous phenomena) is outlined. The three-dimensional view is achieved either by (a) oblique parallel projections of imagined prisms (cylinders) or stepped cones of different height onto a vertical plane taking hidden areas into consideration (hidden-surface removal) or (b) by producing a stereo mate to the parallel projection from (a). System (a) consists in successively moving up the thematic areas or hypsometric layers to their final level while erasing previously generated elements of representation. In this procedure an algorithm operating on a hierarchic basis can save much computing time. The stereo mate according to (b) is formed by repeating the process after slightly changing the given direction of view. ESA

N86-31972# Institut National Polytechnique, Toulouse (France).

INTEGRATION OF THE TOPOGRAPHY IN TELEDETECTION IMAGE DATA PROCESSING Ph.D. Thesis [INTEGRATION DU RELIEF AU TRAITEMENT D'IMAGES DE TELEDETECTION]

C. PROY 1986 188 p In FRENCH
(Contract ATP-84/CNES/1259)
(ETN-86-97652) Avail: NTIS HC A09/MF A01

A method of topographic data acquisition from charts and the analysis of the signal produced by a target in mountainous country are discussed. A simulation procedure was carried out and applied to two Pyrenees regions. In the processed data a better equilibrium of shadow and light is found. It is shown that additional corrections related to aerosols in the atmosphere and surface characteristics are necessary. ESA

N86-31974# National Aerospace Lab., Amsterdam (Netherlands). Space Div.

IMAGE QUALITY CRITERIA WITH EMPHASIS ON CRITERIA FOR REMOTE SENSING IMAGERY

J. C. A. VANDERLUBBE 1 Mar. 1984 94 p Sponsored by Netherlands Agency for Aerospace Programs
(NLR-TR-84040-U; ETN-86-98034) Avail: NTIS HC A05/MF A01

A guide for the measurement of image quality is presented. Common approaches to image quality assessment plus less considered aspects of image quality texture and edge quality are treated. ESA

N86-31977# Wageningen Agricultural Univ. (Netherlands). Dept. of Soil Science and Geology.
INTRODUCTION TO THE INTERPRETATION OF REMOTE SENSING DATA
M. A. MULDERS and D. LEGGER Jan. 1985 27 p
(ETN-86-98067) Avail: NTIS HC A03/MF A01

Aerial photography and other remote sensing techniques; true and false color photography; photointerpretation; map legends; and derivation of soil maps from aerial photointerpretation maps are introduced. ESA

N86-32834# Technische Hogeschool, Delft (Netherlands). Dept. of Electrical Engineering.
MULTIPLE-INPUT SEGMENTATION ALGORITHM FOR SLAR-IMAGERY
J. J. GERBRANDS *In* ESA Microwave Remote Sensing Applied to Vegetation p 35-39 Jan. 1985
Avail: NTIS HC A08/MF A01

An algorithm for automated segmentation of radar imagery of crops is outlined. The procedure is based on a sequential split-and-merge approach which allows for the simultaneous segmentation of multitemporal or multiangular views of the same scene, yielding one segmentation plan. The criteria for merging, splitting or grouping the tentative regions are based on the random scatterer model for natural backgrounds. Results are acceptable, but interactive tuning of the parameters requires considerable experience and run time for a 512 x 256 pixel scene is 50 min. ESA

N86-32848# Dundee Univ. (Scotland).
DATA RECEPTION
P. E. BAYLIS *In* ESA Remote Sensing Applications in Civil Engineering p 15-18 Mar. 1985
Avail: NTIS HC A06/MF A01

Principles of remote sensing satellite image data acquisition, transmission, ground reception, and archiving are summarized. Satellite orbits, Earth scanning techniques, data rates, data frames, codes and bandwidth, radio links, telemetry receivers, data storage, and hard copy production are discussed. ESA

N86-32853# University Coll., London (England).
SPACE CARTOGRAPHY
I. J. DOWMAN *In* ESA Remote Sensing Applications in Civil Engineering p 97-121 Mar. 1985
Avail: NTIS HC A06/MF A01

Means whereby information on a satellite image can be transferred to a map at a suitable scale so that the size or area of the features can be determined; the relative position of the features can be found; information obtained at different times and with different sensors can be compared; and the position of features in a national reference system can be found are discussed. Image rectification is explained using Landsat scanner imagery and radar. Height measurement is shown using space photography and SPOT imagery. ESA

N86-32863*# California Univ., Santa Barbara.
REMOTE SENSING INFORMATION SCIENCES RESEARCH GROUP, SANTA BARBARA INFORMATION SCIENCES RESEARCH GROUP, YEAR 3 Final Report
J. E. ESTES, T. SMITH, and J. L. STAR 5 Jan. 1986 87 p
(Contract NAGW-455)
(NASA-CR-179769; NAS 1.26:179769) Avail: NTIS HC A05/MF A01 CSCL 05B

Research continues to focus on improving the type, quantity, and quality of information which can be derived from remotely sensed data. The focus is on remote sensing and application for the Earth Observing System (Eos) and Space Station, including associated polar and co-orbiting platforms. The remote sensing research activities are being expanded, integrated, and extended into the areas of global science, georeferenced information systems, machine assissted information extraction from image data, and artificial intelligence. The accomplishments in these areas are examined.

N86-32866*# California Univ., Santa Barbara
PILOT LAND DATA SYSTEM
J. L. STAR and J. E. ESTES *In its* Remote Sensing Information Sciences Research Group, Santa Barbara Information Sciences Research Group, year 3 4 p 5 Jan. 1986
Avail: NTIS HC A05/MF A01 CSCL 05B

The Pilot Land Data System (PLDS) is a multi-institutional effort directed towards solving the data access and management needs of scientists studying the land surface. Some of the hardware and software, which are now available, are reviewed. B.G.

N86-32867*# California Univ., Santa Barbara.
RESEARCH UNDERTAKEN AND PROPOSED DIRECTIONS FOR THE COMING YEAR OF THE INFORMATION SYSTEM RESEARCH GROUP Final Summary Report, 1 May 1985 - 30 Apr. 1986
J. E. ESTES and J. L. STAR *In its* Remote Sensing Information Sciences Research Group, Santa Barbara Information Sciences Research Group, year 3 43 p 5 Jan. 1986
Avail: NTIS HC A05/MF A01 CSCL 05B

The basic understanding of the role of information systems technologies and artificial intelligence techniques in the integration, manipulation, and analysis of remotely sensed data for global scale studies is examined. B.G.

N86-32868# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MCT/INPE LANDSAT SYSTEM: REPORT OF ACTIVITIES FROM SEPTEMBER 1, 1985 TO MARCH 31, 1986
J. L. DEBARROSAGUIRRE and S. DEPAULAPEREIRA Jun. 1986 24 p Presented at the LGSOWG and LDDMWG Meetings, Rome, Italy, Jun. 1986
(INPE-3927-PRE/960) Avail: NTIS HC A02/MF A01

The current status of the Brazilian LANDSAT facilities operated by INPE and the results achieved during the period from September 1, 1985 to March 31, 1986 are described. Author

08

INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A86-40584#
THE POLAR PLATFORM OF THE SPACE STATION - A PERMANENT FACILITY FOR METEOROLOGICAL, OCEANOGRAPHIC, AND LAND OBSERVATIONS
E. L. HEACOCK, D. B. MILLER, and S. R. SCHNEIDER (NOAA, National Environmental Satellite, Data and Information Service, Washington, DC) IN: Space Systems Technology Conference, San Diego, CA, June 9-12, 1986, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1986, p 49-59. refs
(AIAA PAPER 86-1174)

The design and capabilities of NASA's Space Station Polar Platform are studied. NOAA's TIROS-N (ATN) spacecraft is the current operational polar-orbiting environmental satellite and it contains sounding, imaging, data collection, and space environment monitoring equipment. The instruments from previous missions for observation of the earth's atmosphere, meteorology, oceans, and land are described. The integration of research instruments, such as the atmospheric and meteorological remote sensing assembly, solar-terrestrial environment sensing assembly, oceanic remote sensing assembly, land remote sensing assembly, data collection and platform location, and satellite-aided search and rescue, into the operational capabilities of the Polar Platform is examined. Current and proposed international contributions to the design and development of the Polar Platform are discussed. I.F.

A86-41286* RCA Advanced Technology Labs., Moorestown, N.J.

SHORTWAVE INFRARED 512 X 2 LINE SENSOR FOR EARTH RESOURCES APPLICATIONS

J. R. TOWER, L. E. PELLON, B. M. MCCARTHY (RCA Advanced Technology Laboratories, Moorestown, NJ), H. ELABD, A. G. MOLDOVAN, W. F. KOSONOCKY (RCA Laboratories, Princeton, NJ), J. E. KALSHOVEN, JR., and D. TOM (NASA, Goddard Space Flight Center, Greenbelt, MD) IEEE Transactions on Electron Devices (ISSN 0018-9383), vol. ED-32, Aug. 1985, p. 1574-1583. refs

(Contract NAS5-27800)

As part of the NASA remote-sensing Multispectral Linear Array Program, an edge-buttable 512 x 2 IRCCD line image sensor with 30-micron Pd2Si Schottky-barrier detectors is developed for operation with passive cooling at 120 K in the 1.1-2.5 micron short infrared band. On-chip CCD multiplexers provide one video output for each 512 detector band. The monolithic silicon line imager performance at a 4-ms optical integration time includes a signal-to-noise ratio of 241 for irradiance of 7.2 microwatts/sq cm at 1.65 microns wavelength, a 5000 dynamic range, a modulation transfer function, greater than 60 percent at the Nyquist frequency, and an 18-milliwatt imager chip total power dissipation. Blemish-free images with three percent nonuniformity under illumination and nonlinearity of 1.25 percent are obtained. A five SWIR imager hybrid focal plane was constructed, demonstrating the feasibility of arrays with only a two-detector loss at each joint. R.R.

A86-41885

STUDY OF MULTIFUNCTION IMAGING AND HIGH-EFFICIENCY DATA PROCESSING SYSTEM FOR REMOTE SENSING

R. KUWANO and R. NAGURA (NEC Corp., Space Development Div., Yokohama, Japan) Institute of Electronics and Communication Engineers of Japan, Transactions, Section E (English) (ISSN 0387-236X), vol. E68, July 1985, p. 421-424.

Multifunction imaging with high-efficiency data compression for remote sensing is achieved by organically combining a simply constructed stereoscopic imaging system and an applied predictive coding. Advancements in the LSI and optical sensor system technique have made possible the satellite employment of a charge coupled device (CCD) electronic scan imaging method. Three signal processing system methods are considered. R.R.

A86-43195*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

THE EARTH RADIATION BUDGET EXPERIMENT - SCIENCE AND IMPLEMENTATION

B. R. BARKSTROM and G. L. SMITH (NASA, Langley Research Center, Hampton, VA) Reviews of Geophysics (ISSN 8755-1209), vol. 24, May 1986, p. 379-390. refs

This paper gives an overview of the Earth Radiation Budget Experiment. The experiment consists of scanning and nonscanning radiometer packages on three spacecraft. One is a satellite with a 57 deg, inclination orbit which processes around the earth once every 2 months. Packages are also flown on the sun-synchronous NOAA-F and NOAA-G operational meteorological satellites. The scanning radiometer includes three channels: shortwave, long-wave, and total. The nonscanner package encompasses a pair of wide-field-of-view radiometers and a pair of medium-field-of-view radiometers. Each pair consists of a total and a shortwave radiometer. The scientific importance and objectives of the mission are described, including the need for the three spacecraft and the utility of the complementary types of radiometers. Author

A86-43225* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

MULTIPLE INSTRUMENT COVERAGE ANALYSIS

G. M. HORVAT (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Astrodynamics 1985; Proceedings of the Conference, Vail, CO, August 12-15, 1985. Part 1 . San Diego, CA, Univelt, Inc., 1986, p. 455-470. NASA-supported research.

(AAS PAPER 85-432)

In the Space Station era comprehensive investigations of the physical processes of the earth will rely on observations from several types of space-based instruments. Preliminary studies indicate that, due to projected limitations on spacecraft and launch-vehicle capability, these complementary instrument sets may have to be distributed among several spacecraft. The task of analyzing the coincident coverage areas between instruments operating from multiple spacecraft will be complex. Such factors as the instruments' observing capabilities, orbital parameters, and viewing constraints will have to be considered. To aid in this analysis a computer model is being developed. This model has the capability, among others, to compute the coincident coverage areas between two independently orbiting instruments. This paper describes the model, its capabilities, and several sample applications. Author

A86-43228* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

POLAR PLATFORM PAYLOAD REQUIREMENTS IN THE 1990'S

D. VANE (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) and M. DONOHOE (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: Astrodynamics 1985; Proceedings of the Conference, Vail, CO, August 12-15, 1985. Part 1 . San Diego, CA, Univelt, Inc., 1986, p. 519-528. NASA-sponsored research. refs

(AAS PAPER 85-396)

NASA's Earth Orbiting System (EOS) and NOAA's operational payloads represent two of the major users of the Space Station Polar Platform capabilities. The EOS program will be designed for Shuttle launch, servicing and on-orbit augmentation, while the NOAA's payload will be designed for the operational monitoring of the earth's atmosphere, oceans, and land masses. An overview is given of both the EOS and NOAA platform programs as well as the implied platform requirements. It is concluded that the generic platform design must be capable of operating at altitudes ranging from Shuttle altitudes to NOAA altitudes (approximately 850 km). In addition, it must be able to accommodate approximately 5000 kg of payload mass, provide 5000 W of continuous power and up to 13 kW of peak power for short durations, and store and transmit data at rates up to 300 Mbps. K.K.

A86-43229* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE EARTH OBSERVING SYSTEM

R. E. HARTLE (NASA, Goddard Space Flight Center, Greenbelt, MD) and A. TUYAHOV (NASA, Washington, DC) IN: Astrodynamics 1985; Proceedings of the Conference, Vail, CO, August 12-15, 1985. Part 1 . San Diego, CA, Univelt, Inc., 1986, p. 529-550.

(AAS PAPER 85-397)

This paper summarizes concepts for an Earth Observing System (EOS) for the 1990s that will provide the observational capabilities and an information system needed to understand how the earth works as a system. The concept diverges somewhat from past practices in that it considers EOS as an information system, where mission operation, EOS data bases and information about other relevant data sets are tied together by an information network. Three EOS instrument packages were chosen on the basis of synergistic groupings of instruments to make simultaneous observations of selected phenomena over a variety of wavelengths. Author

A86-43699

EXPERIMENTS ON THE MILLIMETER-WAVE REMOTE SENSING OF EARTH RESOURCES USING THE SYNTHETIC-APERTURE PRINCIPLE [EKSPERIMENTY PO DISTANTSIONNOMU ISSLEDOVANIIU PRIRODNYKH RESURSOV V MILLIMETROVOM DIAPAZONE RADIOVOLN S ISPOL'ZOVANIEM PRINTSIPA SINTEZIROVANNOI APERTURY]

V. B. SHTEINSHLEIGER, G. S. MISEZHNIKOV, and A. G. SELSKII Radiotekhnika i Elektronika (ISSN 0033-8494), vol. 31, May 1986, p. 1046, 1047. In Russian. refs

A86-44407

ON THE CURRENT-VOLTAGE RELATIONSHIP OF THE MAGNETOSPHERIC GENERATOR AT INTERMEDIATE SPATIAL SCALES

J. F. VICKREY, R. C. LIVINGSTON, N. B. WALKER (SRI International, Menlo Park, CA), T. A. POTEMRA (Johns Hopkins University, Laurel, MD), R. A. HEELIS (Texas, University, Richardson) et al. Geophysical Research Letters (ISSN 0094-8276), vol. 13, June 1986, p. 495-498. refs
(Contract DNA001-85-C-0062; F49620-83-K-0025; F19628-83-K-0021)

Using data from the drift meter and magnetometer on board the HILAT satellite, fluctuations in high latitude electric and magnetic fields at scale sizes between 80 km and 3 km are examined. A comparison of data from summer and winter allows us to assess the impact of changing ionospheric conductivity on the magnetospheric generator. It is found that, at these scale sizes, the magnetosphere tends to behave as a constant current source that is independent of ionospheric conductivity. This characteristic was noted on both open and closed field lines. The electric field pattern, on the other hand, is much more highly structured in the winter than in the summer. This behavior implies scale size dependent potential drops on closed field lines. Author

A86-46063

PHOTOGRAMMETRIC CONSTRUCTION SURVEYS USING A 35 MM CAMERA

J. N. HATZOPOULOS (California State University, Fresno) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 137-146. refs

The use of a 35 mm amateur camera for analytical photogrammetry in construction surveys is presented in detail. Special calibration procedures such as based on the finite element method permit precise detection and compensation of most systematic errors of inner orientation. Project design and processing based on a network structured file system is analysed. Experimentation testing indicates an accuracy of one part in the 10,000 of the photographic distance using a 50 mm lens. Author

A86-46068

ACCURACY OF THREE DIMENSIONAL MEASUREMENT USING STEREO SPACE PHOTOGRAPHS TAKEN BY ZEISS METRIC CAMERA OF SPACELAB 1

S. MURAI and R. MATSUOKA (Tokyo, University, Japan) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 177-184.

The accuracies of a pair of stereo space photographs of the Alps taken with the Carl Zeiss RMK A 30/23 Metric Camera from Spacelab 1 were determined with and without self-calibration using 36 ground control points measured both on the second generation photographs and on 1:50,000 topographic maps. Results obtained with and without 39 pass points selected and measured on the stereo photographs, show bundle adjustment to be a more suitable orientation method than single photograph orientation. The absolute accuracy was found to be poor, while the relative accuracy was suffficient, and the planimetric accuracy of + or - 29.8 m, and the height accuracy of + or 37.3 m, obtained with self-calibration, were in agreement with previous results for the first generation films. R.R.

A86-46086

ULTRA-LIGHT RECONNAISSANCE, ANOTHER TOOL

J. W. WALKER (Brigham Young University, Provo, UT) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 371-380.

Ultralight aircraft and controlled 2 1/4 and 35 mm cameras suspended in differential sponge mounts are found to reduce camera vibration, and make possible the production of sharp eight and 12 diameter large-scale low-altitude aerial photographs. Advantages of the technique include the reduction of blur from low flying speeds and the ability to fly beneath the temperature inversion layers. Results of recent test are reported. R.R.

A86-46110

A VIDEO CAMERA SYSTEM FOR MULTISPFCTRAL SENSING

D. KING, J. VLCEK, and S. SHEMILT (Toronto, University, Canada) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 661-665. NSERC-sponsored research. refs

A brief description is given of a 4-band video data acquisition system designed to operate with one recorder in narrow spectral bands in the visible and near IR spectrum. It is designed to utilize four black and white solid-state cameras, a custom-built multiplexer, one 3/4 or 1/2 inch tape recorder, and a small black and white monitor. The acquired imagery can be played back as is in rapid-band sequencing for viewing or the individual bands can be displayed in 'freeze frame' mode for digitization and computer image processing. The first flight using ultricon tube (f = 8 mm) cameras at three diferent altitudes was conducted in October 1984 north of Toronto. The results given here describe digital analysis at 256 x 256 pixel resolution of two sets of 4-band video taken with 40 nm bandpass filters centered at 550 nm, 650 nm, 700 nm, and 800 nm wavelengths, one set taken at 305 m, and the other at 610 m altitude. Author

A86-46480* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

COMPARISON OF STRATOSPHERIC AIR PARCEL TRAJECTORIES CALCULATED FROM SSU AND LIMS SATELLITE DATA

J. AUSTIN (NASA Langley Research Center, Hampton, VA) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, June 20, 1986, p. 7837-7851. refs
(Contract NCC1-86)

Midstratospheric trajectories for February and March 1979 are calculated using geopotential analyses derived from limb infrared monitor of the stratosphere data. These trajectories are compared with the corresponding results using stratospheric sounding unit data. The trajectories are quasi-isentropic in that a radiation scheme is used to simply cross-isentrope flow. The results show that in disturbed conditions, quantitative agreement the trajectories, that is, within 25 great circle degrees (GCD) (one GCD about 110 km) may be valid for only 3 or 4 days, whereas during quiescent periods, quantitative agreement may last up to 10 days. By comparing trajectories calculated with different data some insight can be gained as to errors due to vertical resolution and horizontal resolution (due to infrequent sampling) in the analyzed geopotential height fields. For the disturbed trajectories described in this paper the horizontal resolution of the data was more important than vertical resolution; however, for the quiescent trajectories, which could be calculated accurately for a longer duration because of the absence of appreciable transients, the vertical resolution of the data was found to be more important than the horizontal resolution. It is speculated that these characteristics are also applicable to trajectories calculated during disturbed and quiescent periods in general. A review of some recently published trajectories shows that the qualitative conclusions of such works remains unaffected when the calculations are repeated using different data. Author

A86-46597

COMPARISON OF GEOS-3 AND SEASAT ALTIMETER RESOLUTION CAPABILITIES

K. M. MARKS and R. V. SAILOR (Analytic Sciences Corp., Reading, MA) Geophysical Research Letters (ISSN 0094-8276), vol. 13, July 1986, p. 697-700. refs

A comparison is made between GEOS-3 and Seasat altimeter data with regard to noise power spectral density (PSD), derived geoid PSD, and short wavelength resolution. At wavelengths greater than 450 km, the noise PSDs for GEOS-3 and Seasat are essentially the same, and are attributed to mesoscale oceanographic effects. At shorter wavelengths, the noise spectra diverge because of the higher GEOS-3 instrument noise. The average along-track geoid PSDs are nearly identical between wavelengths of 4500 and 72 km. The spectral coherence between repeat tracks shows that the short wavelength resolution of Seasat data is about 32 km, and for GEOS-3 it is about 60 km. Author

A86-46722* Arizona Univ., Tucson.

OPERATIONAL MTF FOR LANDSAT THEMATIC MAPPER

R. SCHOWENGERDT, C. ARCHWAMETY (Arizona, University, Tucson), and R. C. WRIGLEY (NASA, Ames Research Center, Moffett Field, CA) IN: Image quality: An overview; Proceedings of the Meeting, Arlington, VA, April 9, 10, 1985 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1985, p. 110-118. refs
(Contract NCC2-234)

The Landsat Thematic Mapper (TM) represents significant improvements in spatial, spectral, and radiometric resolution over the older Multispectral Scanner System (MSS). For the last three years, NASA has conducted the Landsat Image Data Quality Analysis (LIDQA) program to quantify the performance of the TM on the Landsat-4 and 5 spacecraft. As part of this program, analysis of the TM imagery to extract the overall system modulation transfer function (MTF) has been performed. In this paper, the San Mateo Bridge in San Francisco is described as a target for calculation of the line spread function and MTF. The analysis of two TM scenes, one from 12/31/82 and one from 8/12/83, yielded effective-instantaneous-field-of-views (EIFOVs) of 40.8 meters and 48.6 meters, respectively. These values are compared with the 33.8 meter EIFOV predicted by component modelling of the TM sensor, and the differences discussed. Author

A86-46726

SENSOR DESIGN USING COMPUTER TOOLS II; PROCEEDINGS OF THE MEETING, ARLINGTON, VA, APRIL 11, 12, 1985

J. A. JAMIESON, ED. (Jamieson Science and Engineering, Inc., Washington, DC) Meeting sponsored by SPIE. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 550), 1985, 139 p. For individual items see A86-46727 to A86-46736.
(SPIE-550)

The present conference discusses topics in the computerized simulation of electronic sensor performance, subsystem design and testing, quality design and verification, and the relationship of optical engineering professionals to their computer design tools. Attention is given to advances in Landsat image processing and mapping, the modeling of linear scan electrooptic sensors, computer simulation-based design of multispectral scanners, laser imager computer simulation, and precise space telescope pointing by means of a quadrant detector. Also discussed are an adaptive telescope design using computer tools, a focal plane products data base, the use of personal computers in optical design, and the computer simulation of focal plane array performance using coupled ray trace and carrier diffusion models. O.C.

A86-46729

DESIGN OF MULTISPECTRAL SCANNERS USING COMPUTER SIMULATION

F. J. THOMSON (Michigan, Environmental Research Institute, Ann Arbor) IN: Sensor design using computer tools II; Proceedings of the Meeting, Arlington, VA, April 11, 12, 1985 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1985, p. 30-36. refs

Attention is given to the two roles that computer simulation can play in the design of multispectral scanners. Computer models of terrain, illumination geometry, atmospheric effects, and exploitation algorithms can furnish insights into the tradeoffs between important system variables. In addition, simulations can be used to evaluate system performance on the basis of selectively degraded empirical data sets. The combination of the two approaches can be used to furnish support and confirmation for the modeled results, and may also provide pictorial evidence supporting a particular sensor design. O.C.

A86-49441

ON THE MOTION OF SPRAY DROPS IN THE WAKE OF AN AGRICULTURAL AIRCRAFT

M. ATIAS and D. WEIHS (Technion - Israel Institute of Technology, Haifa) Atomisation and Spray Technology (ISSN 0266-3481), vol. 1, 1985, p. 21-36. refs

This paper summarizes results obtained using a mathematical model developed in order to investigate the behaviour of an agricultural airplane wake near the ground and the motion of sprays under the influence of this wake. The model describes the flow field generated following the motion of a pair of concentrated wing-tip vortices near the ground and the motion of evaporating drops in this flow field. As examples for use of this model, the distribution of different initial drop size sprays was investigated as well as the influence of the relative humidity and of changing initial velocity of the drops. Author

A86-49465

METEOSAT - ON STATION COME RAIN, COME SHINE

G. LEBEGUE Revue Aerospatiale (ISSN 0065-3780), July-Aug. 1986, p. 28-33. In English and French.

Meteosat is stationed in GEO and provides data for both public weather forecasts and for an international meteorological datebase. The 2.1 m diam, 3.2 m tall spacecraft carries sensors for the 0.5-0.9 micron (visible), 10.5-12.5 microns (thermal IR), and 5.7-7.1 microns (water vapor) bands which provide signals for real-time transmissions. The sensors are housed in a 40 cm aperture Richey-Chretien telescope and deliver images in the form of 2500 scan lines obtained every 30 min. The Meteosat program was initiated in 1973 by ESA as an eight-nation effort. Although the satellite is spin-stabilized, transmission and reception are handled completely with an electronically despun, entirely static antenna. The products of the satellite data comprise preprocessed images, wind vectors, sea surface temperature, cloud cover at different altitudes, cloud altitudes, humidity and local radiant flux and emissivity. M.S.K.

A86-49604#

THE TRANSPORTABLE REMOTE SENSING STATION TRAFES AND ITS EMPLOYMENT POSSIBILITIES [DIE TRANSPORTABLE FERNERKUNDUNGS-STATION TRAFES UND IHRE EINSATZMOEGLICHEITEN]

R. KATZENBEISSER (Dornier System GmbH, Friedrichshafen, West Germany) BMFT, Statusseminar ueber die Nutzung von Fernerkundungsdaten in der Bundesrepublic Deutschland, Garmisch-Partenkirchen, West Germany, Jan. 20-22, 1986, Paper. 10 p. In German.

It had been found that the coverage provided by stationary installations was not satisfactory in cases involving remote sensing studies conducted by the West German institute BGR, which is concerned with investigations related to the earth sciences and the location of raw materials. This situation led to the design of a transportable S-band station (Landsat MSS) by a German aerospace company in 1979. Considerations related to the

utilization of data provided by the Environmental Research Satellites (ERS) motivated the development of the concept of Trafes, which represents a modification of the first design of a transportable remote sensing station. The requirements which Trafes has to satisfy are discussed. The possibility of a worldwide employment of Trafes at arbitrary locations is important, taking into account also tropical regions and Antarctica. Employment possibilities are related to research, development aid, and commercial projects.
G.R.

A86-49646
GEOSTATIONARY SATELLITE SOUNDING SYSTEM CAPABILITIES FOR THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION OPERATIONS
R. BROWER, R. GIRD, and L. LAURITSON (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) IN: International Conference on Interactive Information and Processing Systems for Meteorology, Oceanography, and Hydrology, 2nd, Miami, FL, January 14-17, 1986, Preprints. Boston, MA, American Meteorological Society, 1986, p. 332-336. refs

The data processing and distribution system developed by NOAA to facilitate utilization of GOES VISSR Atmospheric Sounder (VAS) remote-sensing data by U.S. National Weather Service centers is characterized and illustrated with block diagrams. The VAS Data Utilization Centers (VDUCs) being installed are real-time interactive processing and display systems permitting rapid integration of VAS data with weather information from other sources. Each VDUC employs a configuration comprising a central processor with 16-Mb main memory, a 7.5-Gb disk-storage unit, eight interactive work stations, three programmer terminals, and additional peripherals. The hardware and file-management strategy of VDUC are described, and the types of VAS products needed for severe-storm, hurricane, and winter-storm forecasting are listed. The possible use of VAS data for wind determinations is discussed.
T.K.

A86-50274* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HIGH SPECTRAL RESOLUTION REMOTE SENSING OF THE EARTH
G. VANE (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) Sensors (ISSN 0746-9462), Dec. 1985, 7 p. NASA-supported research. refs

Early results of a major advance in remote sensing called imaging spectrometry (IS), the simultaneous acquisition of images in many narrow contiguous spectral bands throughout the visible and solar-reflected infrared portions of the spectrum, are discussed. The motivation for IS is reviewed, and the performance of IS is examined, describing prototype sensors. The analysis of IS data is addressed, including the problem of visual interaction with hyperspectral images and their statistical properties, and the effect of data dimensionality on multispectral scene classification. A test of the capability of imaging spectrometry to identify minerals is reported.
C. D.

N86-28499*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SHUTTLE IMAGING RADAR VIEWS THE EARTH FROM CHALLENGER: THE SIR-B EXPERIMENT
J. P. FORD, J. B. CIMINO, B. HOLT, and M. R. RUZEK 15 Mar. 1986 146 p
(Contract NAS7-918)
(NASA-CR-177158; JPL-PUB-86-10; NAS 1.26:177158) Avail: NTIS HC A07/MF A01 CSCL 08B

In October 1984, SIR-B obtained digital image data of about 6.5 million km2 of the Earth's surface. The coverage is mostly of selected experimental test sites located between latitudes 60 deg north and 60 deg south. Programmed adjustments made to the look angle of the steerable radar antenna and to the flight attitude of the shuttle during the mission permitted collection of multiple-incidence-angle coverage or extended mapping coverage as required for the experiments. The SIR-B images included here are representative of the coverage obtained for scientific studies in geology, cartography, hydrology, vegetation cover, and oceanography. The relations between radar backscatter and incidence angle for discriminating various types of surfaces, and the use of multiple-incidence-angle SIR-B images for stereo measurement and viewing, are illustrated with examples. Interpretation of the images is facilitated by corresponding images or photographs obtained by different sensors or by sketch maps or diagrams.
Author

N86-29175 Deutsche Geodaetische Kommission, Munich (West Germany).
CAMERA CALIBRATION IN PHOTOGRAMMETRIC PRACTICE [KAMMERKALIBRIERUNG IN DER PHOTOGRAMMETRISCHEN PRAXIS]
G. KUPFER, ed. and W. WESTER-EBBINGHAUS, ed. 1985 181 p In GERMAN Conf. held in Bonn, 21-22 Feb. 1985
(SER-B-275; ISBN-3-7696-8562-8; ISSN-0065-5317; ESA-86-96925) Avail: Issuing Activity

Research on calibration of air cameras for precision photogrammetry is reviewed. Laboratory and field calibrations are compared. Applications of photogrammetric systems are presented (in coal mining, car industry robots, monitoring of churches in subsidence areas).
ESA

N86-29176 Bonn Univ. (West Germany).
CAMERA CALIBRATION IN PHOTOGRAMMETRIC PRACTICE, INTRODUCTION [KAMMER-KALIBRIERUNG IN DER PHOTOGRAMMETRISCHEN PRAXIS - EINE EINFUEHRUNG]
G. KUPFER *In* Deutsche Geodaetische Kommission Camera Calibration in Photogrammetric Practice p 7-10 1985 In GERMAN
Avail: Issuing Activity

Laboratory, stellar and ground calibrations are developed to assess accuracy and reliability of photographic systems and their components. Calibration of photographic systems is based on analytic assessment systems and software and calibration of aerial images in close-range photogrammetry. Algorithms to obtain simultaneous calibration of photographic systems and aerial images are developed. System reproduction, film printing plate flatness, filter glass plane parallelism, and definition of image plane or image coordinate system are calibrated in laboratory with a visual procedure using goniometers, theodolites and lens/mirror systems. Stellar calibration with or without filters is influenced by emulsion sensitivity. Ground calibration is based on image measurement and geodetic observations. Economical application of the different procedures is assessed.
ESA

N86-29177 Zeiss (Carl), Oberkochen (West Germany).
ON ACCURACY OF LABORATORY CALIBRATIONS AND ON AERIAL CAMERA STABILITY WITH THE EXAMPLE OF SPACELAB RMK A 30/23 [UEBER DIE GENAUIGKEIT VON LABORKALIBRIERUNGEN UND DIE STABILITAET VON LUFTBILDKAMMERN AM BEISPIEL DER SPACELAB-RMK A 30/23]
H. K. MEIER *In* Deutsche Geodaetische Kommission Camera Calibration in Photogrammetric Practice p 11-14 1985 In GERMAN
Avail: Issuing Activity

The RMK A 30/23 camera was selected for the Metric Camera experiment on the first Spacelab mission devised to determine laboratory calibration accuracy and RMK stability, based on 1000 high resolution color and black and white measurement images and to determine the applicability of photogrammetric snap shots in 1:100,000 or 1:50,000-scale mapping. Comparison of the calibrations performed in various laboratories with different calibration procedures and instruments shows good homogeneity. Calibrations of RMK A 30/23 before and after Spacelab mission show good geometric quality. The RMK A 30/23 is further improved with forward motion compensation to attain 2x to 10x basic resolution with equal geometric quality.
ESA

N86-29180 Ecole Polytechnique Federale de Lausanne (Switzerland).
COMPARATIVE ANALYSIS OF CAMERAS [VERGLEICHENDE ANALYSE VON AUFNAMEKAMMERN]
O. KOELBL *In* Deutsche Geodaetische Kommission Camera Calibration in Photogrammetric Practice p 48-64 1985 In GERMAN
Avail: Issuing Activity

Image quality and metric precision for Zeiss Jena LMK with automatic forward motion compensation, Wild Heerbrugg RC 10A, and Zeiss Oberbrocken RMK are analyzed. Image quality is analyzed using modulation transmission function under flight conditions and metric precision with aerotriangulation of a photogrammetric block (6 lines: 7 images). The test field and the photographic mission are described. Field measurements show better image quality than laboratory measurements. Comparison of the results on Panatomic-X Film and Plus-X Film show little enhancement of measurement accuracy with increased resolution capacity. ESA

N86-29195 Technische Univ., Hanover (West Germany).
CALIBRATION OF A DIGITAL CAMERA SYSTEM [KALIBRIERUNG EINES DIGITALEN AUFNAHMESYSTEMS]
T. LUHMANN *In* Deutsche Geodaetische Kommission Camera Calibration in Photogrammetric Practice p 165-173 1985 In GERMAN
Avail: Issuing Activity

Calibration of a CCD surface sensor and of a photogrammetric reproduction system is presented. A digital system including a camera with an 80 mm lens, a 120 mm lens for reproduction in the sensor surface, and a CCD camera without lens is calibrated. Analog-to-digital conversion, coordinate measurement, and data transfer are performed. Images are subjected to simultaneous calibration to determine the 3-D target point coordinates of the test field and the internal and external orientation parameters after bundle adjustment. Without previous image processing, accuracy is 10 to 20 micron. The CCD surface sensors can be applied in photogrammetric systems and as sensors for large-scale analog-to-digital conversion of measuring images. Digital image production and processing can be applied in photogrammetric point determination. ESA

N86-29196 Technische Hochschule, Darmstadt (West Germany).
PHOTOGRAMMETRIC PROPERTIES OF FILM CAMERA LINHOF AERO TECHNICA 45 AFTER SIMPLE TRANSFORMATIONS [PHOTOGRAMMETRISCHE EIGNESCHAFTEN DER FILMKAMERA LINHOF AERO TECHNIKA 45 NACH EINFACHEN UMBAUTEN]
G. BERG, A. BERGMANN, and B. WROBEL *In* Deutsche Geodaetische Kommission Camera Calibration in Photogrammetric Practice p 174-181 1985 In GERMAN
Avail: Issuing Activity

Photogrammetric properties and utility for aerial surveys of a 9 x 12 camera were assessed. Flatness of the image surface and camera internal orientation are studied. The camera was modified to meet photogrammetric requirements. Images are processed using bundle adjustment for field calibration of the camera. The maximum deviation is 2 mm for the spatial coordinates. According to the price-to-performance ratio, the camera is a feasible alternative to other cameras. Further investigations to obtain more accuracy through better image flatness are recommended. ESA

N86-29282*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROCEEDINGS OF THE SECOND PILOT CLIMATE DATA SYSTEM WORKSHOP
1986 268 p Workshop held in Greenbelt, Md., 29-30 Jan. 1986
(NASA-CP-2430; NAS 1.55:2430) Avail: NTIS HC A12/MF A01 CSCL 04B

The proceedings of the workshop held on January 29 and 30, 1986 are discussed. Data management, satellite radiance data, clouds, ultraviolet flux variations in the upper atmosphere, rainfall during El Nino events, and the use of optical disks are among the topics covered.

N86-29487# General Accounting Office, Washington, D. C. Resources Community and Economic Development Div.
WEATHER SATELLITES: USER VIEWS ON THE CONSEQUENCES OF ELIMINATING A CIVILIAN POLAR ORBITER
Mar. 1986 62 p
(PB86-180254; GAO/RCED-86-111; B-222140) Avail: NTIS HC A04/MF A01 CSCL 04B

It was found that the polar orbiters are used by NOAA for weather forecasting, search and rescue operations, and other purposes; by NASA for climate research; by DOD as a supplement and backup to its own weather satellites; and by countries worldwide for weather forecasting and environmental data collection. Some users in NOAA and DOD reported that the elimination of one of NOAA's polar-orbiting weather satellites would harm their programs, but most users said that they would continue their programs with one satellite. All user's, however, said that the second satellite was important as a backup to the first and that the loss of all service would have serious consequences. GRA

N86-30124*# Princeton Univ. Observatory, N. J.
EVALUATION OF SELECTED DETECTOR ARRAYS FOR SPACE APPLICATIONS Final Report, 1 Jun. 1982 - 30 Jun. 1985
J. L. LOWRANCE Jun. 1985 31 p
(Contract NAG5-241)
(NASA-CR-176979; NAS 1.26:176979) Avail: NTIS HC A03/MF A01 CSCL 14B

The development of a high density Schottky barrier Infrared Charged Coupled Device (IRCCD) type image sensor for earth observation was initiated. A dual band 512 pixel linear array was developed, which was capable of being butted end to end to make an arbitrarily long linear array. Measurement made on palladium silicide IRCCDs that were two-dimensional 63 x 32 pixel arrays were summarized. The test data on a 512 pixel linear array is also summarized. B.G.

N86-30249# Netherlands Agency for Aerospace Programs, Delft.
REPORT ON THE PHASE A STUDY OF A JOINT INDONESIAN-NETHERLANDS TROPICAL EARTH RESOURCES SATELLITE (TERS) PROGRAM
M. IRSYAM, ed. and A. P. HOEKE, ed. Feb. 1985 45 p
(JTERS-84-10; ETN-86-97498) Avail: NTIS HC A03/MF A01

The baseline of the Tropical Earth Resources Satellite (TERS) System was established. Using the possibilities of the high true equatorial orbit, 4 observation opportunities per day, a coverage area of at least 10 deg N to 10 deg S latitude, and the selective viewing capability combined with a cloud sensor, the TERS concept is an appropriate system to complement and to compete with the conventional systems with optical instruments and planned radar systems. User requirements for TERS as a monitoring device for Indonesia are specified. Results of a cost/benefit assessment indicate expected benefits which for Indonesia alone may justify the investment. The political/legal aspects were assessed and a public information plan was drafted. ESA

N86-31085# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE X-SAR SCIENCE TEAM
H. OETTL *In its* The X-SAR Science Plan p 7-10 Nov. 1985
Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 32

The SIR-C X-band SAR mission for remote sensing of weather, oceans, ice, vegetation, pollution, and geological features is introduced. Mission objectives include comparison of different polarizations and investigations of frequencies for SAR applications. ESA

N86-31087# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
RADAR TECHNOLOGY
F. HEEL and D. SOLIMINI *In its* The X-SAR Science Plan p 27-41 Nov. 1985
Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 32

Atmospheric and ionospheric effects on SAR signal performance in the frequency range of the X-SAR/SIR-C mission are reviewed. Mission accompanying ground truth activities and calibration facilities are discussed. Processor capability to achieve improved SAR image quality is assessed. ESA

N86-31094*# National Aeronautics and Space Administration, Washington, D.C.
EARTH OBSERVING SYSTEM. DATA AND INFORMATION SYSTEM. VOLUME 2A: REPORT OF THE EOS DATA PANEL
1986 63 p
(NASA-TM-87777; NAS 1.15:87777) Avail: NTIS HC A04/MF A01 CSCL 05B

The purpose of this report is to provide NASA with a rationale and recommendations for planning, implementing, and operating an Earth Observing System data and information system that can evolve to meet the Earth Observing System's needs in the 1990s. The Earth Observing System (Eos), defined by the Eos Science and Mission Requirements Working Group, consists of a suite of instruments in low Earth orbit acquiring measurements of the Earth's atmosphere, surface, and interior; an information system to support scientific research; and a vigorous program of scientific research, stressing study of global-scale processes that shape and influence the Earth as a system. The Eos data and information system is conceived as a complete research information system that would transcend the traditional mission data system, and include additional capabilties such as maintaining long-term, time-series data bases and providing access by Eos researchers to relevant non-Eos data. The Working Group recommends that the Eos data and information system be initiated now, with existing data, and that the system evolve into one that can meet the intensive research and data needs that will exist when Eos spacecraft are returning data in the 1990s. Author

N86-31097# Royal Netherlands Aircraft Factories Fokker, Amsterdam.
PHASE A TECHNICAL STUDY SUMMARY REPORT FOR A TROPICAL EARTH RESOURCES SATELLITE (TERS)
1984 116 p Prepared in cooperation with National Aerospace Lab., Amsterdam, Netherlands, Signaal, Utrecht State Univ., Netherlands, and Technische Physische Dienst TNO-TH, Delft, Netherlands
(JTERS-84-07; ETN-86-97496) Avail: NTIS HC A06/MF A01

The high (1681 km) equatorial orbit of the Tropical Earth Resources Satellite with its particle radiation hazards (as compared to an alternative low near equatorial orbit with operational complications) was studied. Selective viewing by cloud sensor and cross track instrument pointing was analyzed. The consequences of the high spectral resolution (20 m color, 10 m panchromatic) for the designs of instrument, satellite systems, data handling, and ground data processing were assessed. Ground observations at different solar illumination angles and view angles were simulated. A satellite configuration concept was defined. The concept seems feasible, although it is technologically challenging. Radiation aspects require a careful development and may influence the design of instrument and spacecraft systems. ESA

N86-31098# Royal Netherlands Aircraft Factories Fokker, Amsterdam.
PROPOSAL TO NIVR FOR A SYSTEM DEFINITION STUDY OF A TROPICAL EARTH RESOURCES SATELLITE (TERS)
1984 158 p Prepared in cooperation with National Aerospace Lab., Amsterdam, Netherlands, Signaal, Utrecht State Univ., Netherlands, and Technische Physische Dienst TNO-TH, Delft, Netherlands
(NTERS-84-11; ETN-86-97497) Avail: NTIS HC A08/MF A01

A study to provide a technical definition of the Tropical Earth Resources Satellite (TERS) spacecraft, ground station, data preprocessing facilities and satellite operations in sufficient detail for a reliable estimate of the required budget and time for the realization of a TERS project is proposed. It should also provide a better insight into the feasibility aspects of such a project. The technical definition includes system and subsystem design specifications, and definition of the products to be supplied to the users. The execution of the project is defined up to and including the in-orbit checkout. ESA

N86-31126*# Geological Survey, Denver, Colo.
A REGIONAL 17-18 MA THERMAL EVENT IN SOUTHWESTERN ARIZONA
W. E. BROOKS *In* Lunar and Planetary Inst. Papers Presented to the Conference on Heat and Detachment in Crustal Extension on Continents and Planets p 18-21 1985
Avail: NTIS HC A08/MF A01 CSCL 08G

A regional thermal event in southwestern Arizona 17 to 18 Ma ago is suggested by discordances between fission track (FT) and K-Ar dates in Tertiary volcanic and sedimentary rocks, by the abundance of primary hydrothermal orthoclase in quenched volcanic rocks, and by the concentration of Mn, Ba, Cu, Ag, and Au deposits near detachment faults. A high condont alteration index (CAI) of 3 to 7 is found in Paleozoic rocks of southwestern Arizona. The high CAI may have been caused by this mid-Tertiary thermal event. Resetting of temperature-sensitive TF dates (2) 17 to 18 Ma with respect to K-Ar dates of 24 and 20 Ma has occurred in upper plate volcanic rocks at the Harcuvar and Picacho Peak detachments. Discordances between FT and K-Ar dates are most pronounced at detachment faults. However, on a regional scale Ft dates from volcanic and sedimentary rocks approach 17 to 18 Ma event in areas away from known detachment faults. Effects of detachment faulting on the K-Ar system suggest that dates of correlative rocks will be younger as the detachment fault is approached. Author

N86-31633*# National Aeronautics and Space Administration, Washington, D.C.
NASA TO LAUNCH NOAA-G WEATHER SATELLITE
J. KUKOWSKI, B. LITTIN, and J. ELLIOTT 19 Aug. 1986 11 p
(NASA-TM-89245; NASA-NEWS-RELEASE-86-115; P86-10175; NAS 1.15:89245) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, BWI Airport, Md. 21240
CSCL 22B

A meteorological weather satellite, NOAA-G, is scheduled to be launched from Vandenberg Air Force Base, Calif., aboard a U.S. Air Force Atlas-E launch vehicle, no earlier than 11:47 a.m., EDT, August 30. The satellite, a third-generation operational weather satellite, will be placed into a near-polar orbit at an altitude of 518 miles. The spacecraft, NOAA-10 in orbit, will circle the globe 14 times each day observing a different position of the Earth's surface on each revolution as the Earth turns beneath the spacecraft's orbit. It will become the morning satellite, joining NOAA-9, in NOAA's two polar orbit satellite system. The satellite's orbital period will be approximately 101 minutes. The orbit is planned to be Sun synchronous so that the spacecraft will cross the equator at approximately 7:30 a.m. (southbound) and 7.30 p.m. (northbound), local solar time. Like other NOAA satellites, NOAA-G will collect meteorological data and transmit the information directly to users around the world to enhance local weather analysis and forecasting. In addition to assisting in local weather forecasting, the satellite data are used for hurricane tracking and warning, and for agricultural, commercial fishing, forestry, maritime and other industrial uses. Author

N86-31944*# Rochester Inst. of Tech., N. Y. School of Photographic Arts and Sciences.
LANDSAT 4 BAND 6 DATA EVALUATION Quarterly Report
15 Sep. 1984 6 p
(Contract NAS5-27323)
(NASA-CR-177173; NAS 1.26:177173; QR-8) Avail: NTIS HC A02/MF A01 CSCL 05B

The objectives of this investigation are to evaluate and monitor the radiometric integrity of the LANDSAT-D Thematic Mapper (TM) thermal infrared channel (Band 6) data to develop improved radiometric preprocessing calibration techniques for removal of atmospheric effects. Efforts this period have concentrated on underflight data collection. Two successful flights were made on September 18 and October 6. The radiosonde data for these flights have been obtained. Author

N86-31945*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT-4 AND LANDSAT-5 MULTISPECTRAL SCANNER COHERENT NOISE CHARACTERIZATION AND REMOVAL
J. C. TILTON and W. L. ALFORD, principal investigators (Defense Mapping Agency, Washington, D.C.) May 1986 46 p Original contains color illustrations
(NASA-TP-2595; REPT-86B0040; NAS 1.60:2595) Avail: NTIS HC A03/MF A01 CSCL 14B

A technique for characterizing the coherent noise found in LANDSAT-4 and LANDSAT-5 multispectral scanner (MSS) data is described along with a companion technique for filtering out the coherent noise. The techniques are demonstrated on LANDSAT-4 and LANDSAT-5 MSS data sets, and explanations of the noise pattern are suggested. A cookbook procedure of characterizing and filtering the coherent noise using special NASA/Goddard IDIMS functions is included. Also presented are analysis results from the retrofitted LANDSAT-5 MSS sensor which shows that the coherent noise has been substantially reduced. Author

N86-31970# Begeleidingscommissie Remote Sensing, Delft (Netherlands).
ACTIVITIES REPORT IN REMOTE SENSING SUPERVISION Annual Report, 1983 [JAARVERSLAG 1983]
1984 52 p In DUTCH
(ETN-86-97383) Avail: NTIS HC A04/MF A01

Remote sensing application to sea surface investigations (ship microwave radar systems for wave observation, spectrophotometry of surface water, and oil detection using multispectral scanners, laser fluoro sensors, and high frequency radar techniques); agriculture and nature protection (field spectrometer measurements to determine biomass, thermal images and false color photographs to determine the hydrological soil condition, detection of crop damage and illness caused by pollution and/or heat, and cadastral mapping); and town and country planning are discussed. Processing of remote sensing data is considered. ESA

N86-32006*# Little (Arthur D.), Inc., Cambridge, Mass.
SPACE SYSTEMS REQUIREMENTS DEFINITION
In its System Study of the Utilization of Space for Carbon Dioxide Research p 112 Oct. 1985
Avail: NTIS HC A23/MF A01 CSCL 04B

The compilation of Scientific Data Requirements (SDRs) were based on discussions with a representative cross section of the scientific community and a selected survey of the extensive literature dealing with the measurement of CO2-induced climatic changes. This approach resulted in a baseline set of SDRs to determine what could be accomplished with space-based sensors. Twenty-three SDRs emerged as the basis for the investigation of space systems. B.G.

N86-32014# Naval Postgraduate School, Monterey, Calif.
DETERMINATION OF THE ATMOSPHERIC AEROSOL DISTRIBUTION BY MULTI-CHANNEL REMOTE SENSING TECHNIQUES M.S. Thesis
S. R. BULFINCH Mar. 1986 86 p
(AD-A167865) Avail: NTIS HC A05/MF A01 CSCL 04A

A simple image processing technique applied to channel 1 and channel 2 of the NOAA AVHRR sensor may be used to discern variations in aerosol particle size distribution. Ratios of the channel 1 albedo to the channel 2 albedo are calculated and displayed as an image. High ratio values are shown to indicate increased levels of submicron aerosols, while low ratio values indicate increased levels of supermicron aerosols. Horizontal variations in aerosol distributions may be observed directly by noting variations in ratio values, and vertical distributions may be inferred through the application of appropriate regional models of aerosol transport. A model of offshore advection of urban particles within the marine boundary layer is presented. Interpreting ratio values in light of this model, the offshore transport of urban aerosol particles is observed in AVHRR imagery of Sourthern California during the period 17-25 October 1984. Author (GRA)

N86-32276# Georgia Inst. of Tech., Atlanta.
REAL TIME MATH MODEL FOR INFRARED Final Technical Report, Jun. 1983 - Sep. 1985
D. R. HERTLING and R. C. REARICK Jan. 1986 59 p
(Contract F30602-81-C-0185)
(AD-A168133; GIT/E4857A-85; RADC-TR-85-247) Avail: NTIS HC A04/MF A01 CSCL 17E

The main objective of this work was to access the feasibility of developing a real time math model which could be used to process infrared imagery with current real-time stereo compilation equipment. A survey of existing infrared sensors, imaging sensors, photogrammetric techniques and procedures for stereo viewing and plotting are pesented. A flexible system model was developed which can be adapted to various types of infrared imaging systems. Investigations revealed that the photogrammetric techniques accurate enough for mapping and targeting applications require accurate flight dynamics data which must be simultaneously recorded with the imagery. It is theoretically possible to process certain images which contain known or analytically solvable ground information; however, such procedures would depend upon the image itself and would not be amenable to evolving into a generalized math model. GRA

N86-32819# Danish Meteorological Inst., Copenhagen.
OPERATIONAL EXPERIENCES WITH THE ARGOS SYSTEM IN GREENLAND
F. JENSEN *In* CNES The 10th ARGOS Users Conference 14 p 1985
Avail: NTIS HC A14/MF A01

The ARGOS system was deployed as a primary communication system for automatic weather stations distributed along the coast of Greenland. Operational experience with ARGOS is good and, for the northernmost stations, this system is considered to provide the best and the most simple means of data communication. Since Greenland is located in the polar region the ARGOS system gives nearly consecutive coverage as regards synoptic measurements if the system comprises two satellites with orbits reasonably well separated. ESA

N86-32822# Norwegian Defence Research Establishment, Kjeller.
DESCRIPTION OF THE NORWEGIAN DOPPLER POSITIONING PROGRAM
P. H. ANDERSEN, K. AKSNES, and E. HAUGEN (Royal Norwegian Council for Scientific and Industrial Research, Oslo) *In* CNES The 10th ARGOS Users Conference 10 p 1985
Avail: NTIS HC A14/MF A01

A satellite Doppler positioning program was developed. The sequential version of the program updates the satellite parameters and then performs the transmitter positioning. A version which utilizes Doppler data over several passes for the updating of orbital elements and estimation of unknown positions in a simultaneous manner was written. Results indicate that this procedure gives more accurate estimates of the positions than the sequential method. ESA

N86-32843# Technische Hogeschool, Delft (Netherlands). Microwave Lab.
THE DELFT UNIVERSITY OF TECHNOLOGY SCATTEROMETER (DUTSCAT): A SIX-FREQUENCY AIRBORNE SCATTEROMETER
E. P. W. ATTEMA and P. SNOEIJ *In* ESA Microwave Remote Sensing Applied to Vegetation p 127-129 Jan. 1985 Sponsored by Delft University and Netherlands Remote Sensing Board
Avail: NTIS HC A08/MF A01

The Delft University of Technology Scatterometer is a multiband coherent pulse scatterometer installed in a Beechcraft Queen Air research aircraft. The radar system uses a 0.9 m diameter dual polarized parabolic dish antenna mounted on a support structure and protected by a radome. In the support structure the RF parts of the radar are mounted. This whole system can be tilted between 0 and 80 deg incidence angle, looking to the left. The incidence angle and polarization are selected by the operator inside the aircraft. Frequencies are between 1.2 and 17.25 GHz. It is used for vegetation studies. ESA

N86-32864*# California Univ., Santa Barbara.
SUPPORT FOR GLOBAL SCIENCE: REMOTE SENSING'S CHALLENGE
J. E. ESTES and J. L. STAR *In its* Remote Sensing Information Sciences Research Group, Santa Barbara Information Sciences Research Group, year 3 13 p 5 Jan. 1986
Avail: NTIS HC A05/MF A01 CSCL 05B

Remote sensing uses a wide variety of techniques and methods. Resulting data are analyzed by man and machine, using both analog and digital technology. The newest and most important initiatives in the U. S. civilian space program currently revolve around the space station complex, which includes the core station as well as co-orbiting and polar satellite platforms. This proposed suite of platforms and support systems offers a unique potential for facilitating long term, multidisciplinary scientific investigations on a truly global scale. Unlike previous generations of satellites, designed for relatively limited constituencies, the space station offers the potential to provide an integrated source of information which recognizes the scientific interest in investigating the dynamic coupling between the oceans, land surface, and atmosphere. Earth scientist already face problems that are truly global in extent. Problems such as the global carbon balance, regional deforestation, and desertification require new approaches, which combine multidisciplinary, multinational research teams, employing advanced technologies to produce a type, quantity, and quality of data not previously available. The challenge before the international scientific community is to continue to develop both the infrastructure and expertise to, on the one hand, develop the science and technology of remote sensing, while on the other hand, develop an integrated understanding of global life support systems, and work toward a quantiative science of the biosphere. Author

N86-32903*# National Aeronautics and Space Administration, Washington, D.C.
SPECTROSCOPIC DATABASE
N. HUSSON, A. BARBE, L. R. BROWN, B. CARLI, A. GOLDMAN, H. M. PICKETT, A. E. ROCHE, L. S. ROTHMAN, and M. A. H. SMITH *In its* Atmospheric Ozone 1985. Assessment of our Understanding of the Processes Controlling its Present Distribution and Change, Volume 3 41 p 1985
Avail: NASA, Goddard Space Flight Center, Code 610, Greenbelt, Md. 20770 HC free; NTIS HC A23/MF A01 CSCL 04A

Several aspects of quantitative atmospheric spectroscopy are considered, using a classification of the molecules according to the gas amounts in the stratosphere and upper troposphere, and reviews of quantitative atmospheric high-resolution spectroscopic measurements and field measurements systems are given. Laboratory spectroscopy and spectral analysis and prediction are presented with a summary of current laboratory spectroscopy capabilities. Spectroscopic data requirements for accurate derivation of atmospheric composition are discussed, where examples are given for space-based remote sensing experiments of the atmosphere: the ATMOS (Atmospheric Trace Molecule) and UARS (Upper Atmosphere Research Satellite) experiment. A review of the basic parameters involved in the data compilations; a summary of information on line parameter compilations already in existence; and a summary of current laboratory spectroscopy studies are used to assess the data base. B.G.

09

GENERAL

Includes economic analysis.

A86-41154* Alabama Univ., Huntsville.
COMMERICAL USE OF SPACE - STATUS AND PROSPECTS
C. A. LUNDQUIST (Alabama, University, Huntsville) and W. C. SNODDY (NASA, Marshall Space Flight Center, Huntsville, AL) IN: Winter National Design Engineering Show and Conference, Anaheim, CA, December 11-13, 1985, Conference Talks . Stamford, CT, Cahners Exposition Group, 1985, p. 225-239. refs

The development of commercial enterprises in space is discussed. The convenience and cost-effectiveness of satellites for communications are examined; satellite communications is an established industry and continues to grow. Meteorological satellites and remote sensing satellite systems (Landsat and SPOT) are being utilized to collect earth resources data. The development of materials processing facilities in space is studied. Current and proposed systems for transporting payloads to space and space lab facilities are investigated. The advantages a space station will provide to communications, earth resources, and materials processing are analyzed. The role of governments in the commercialization of space is described. I.F.

A86-41901
SPACE TECHNOLOGY AND RESOURCE MANAGEMENT
P. S. THACHER Journal of International Affairs (ISSN 0022-197X), vol. 39, Summer 1985, p. 151-166. refs

The applications of space technology to the management of natural resources are examined. Meteorological and oceanographic satellite data, MSS and thematic mapper images, and Space Shuttle recorded images are useful for monitoring resources; these satellite data are utilized for determining weather conditions (droughts) and vegetation indices, especially in Africa. Long-range research on the global processes of the earth, in order to understand biogeochemical cycles and the links between geophysical and biospheric processes is described. The relationship between desertification, famine, and droughts are analyzed. The development of the Global Environmental Monitoring System which collects and analyzes meteorological data related to global resources and environmental issues is discussed. The objectives of NASA's earth science research programs and the Global Resources Information Database are considered. The need for international cooperation for resource management and the role of the UN in monitoring natural resources are studied. I.F.

A86-43717
REMOTE SENSING FROM SPACE
B. R. K. PFEIFFER (ESA, Earth Observation Programmes Dept., Noordwijk, Netherlands) IN: SPACECOM '85; Space and Radiocommunications Symposium, 5th, Paris and Le Bourget, France, June 5-7, 1985, Speakers' Papers . Geneva, Switzerland, International Telecommunication Union, 1985, p. 195-201.

This paper provides an overview of the world-wide activities of remote sensing from space. It covers the main categories of instruments, giving examples from previous missions, and describes the type of products obtained. A summary of past and present remote sensing missions is given, and an outline of future missions and trends is included. Typical uses of remote sensing data in science and applications are mentioned. Author

A86-44401

A US DILEMMA - SATELLITE REMOTE SENSING PRIVATIZATION

P.-M. ADRIEN (Project Management Associates, Inc., Vienna, VA) Space Policy (ISSN 0265-9646), vol. 2, May 1986, p. 93, 94.

The legislative mandate issued by Congress through the Land Remote Sensing Act brought about the privatization of the Landsat program in 1985. It is pointed out that as a result of this development the U.S. has embarked on a unique experiment. The U.S. would like to obtain a part of the profits expected to be derived from the market for satellite remote sensing products. However, a realization of such plans would require that the U.S. maintains its leadership in modern remote sensing technology. It is felt that the implementation of such plans is difficult in the light of the Gramm-Rudman amendment. A way has to be found to overcome these difficulties, because a failure to do so would result in the loss of the leadership in remote sensing technology to other countries. G.R.

A86-45518

THE SPOT PROGRAM - HISTORY, GOALS, SYSTEM DESCRIPTION AND GENERAL ORGANIZATION [LE PROGRAMME SPOT - HISTORIQUE, OBJECTIFS, DESCRIPTION DU SYSTEME ET ORGANISATION GENERALE]

G. BRACHET (SPOT Image, S.A., Toulouse, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 100, 1985, p. 13-25. In French.

The observational objectives and design and performance parameters of the SPOT remote sensing satellite are summarized. SPOT will monitor air, land, water and vegetation characteristics and changes with uniform quality whole-earth multitemporal coverage. The SPOT program was initiated by French, Belgium and Swedish agencies in the mid-1970s after initial successes with the Landsat program had identified the numerous applications which could benefit from access to high-quality satellite-based remote sensing imagery. SPOT has two imaging sytems, a monochromatic sensor with 10 m ground resolution and a color scanner furnishing 20 m resolution on a swath 27 deg wide. The 830 km altitude, circular, heliosynchronous SPOT orbit was selected to permit repeat coverage of any location on earth every 26 days. SPOT has on-board data storage capabilities for delaying data transmission until a ground station is in view. The organization of the agencies responsible for manufacturing, operating and maintaining SPOT and disseminating and marketing the data is outlined. M.S.K.

A86-46065

COMMERCIALIZING THE LAND VIEWING SATELLITES - WHO PAYS?

J. C. PRICE (USDA, Agricultural Research Service, Beltsville, MD) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 152-159. refs

The commercialization of remotely sensed data is discussed with emphasis on the benefits derived from the satellite operator selling proprietary computer systems and encrypted data at a lower cost than that of standard format data. The encoding of satellite data would facilitate user analysis while reducing unauthorized data reproduction. Methods implied from information theory, as well as the classification of images from Landsat data and the use of hashing tables, are considered. R.R.

A86-46959*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EARTH OBSERVATIONS IN THE TWENTY-FIRST CENTURY

M. A. GELLER (NASA, Goddard Space Flight Center, Greenbelt) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NV, Sept. 3-5, 1986. 12 p.
(AIAA PAPER 86-2345)

Some of the achievements of earth observations from past space missions are described. Also discussed are the achievements to be anticipated from currently approved and planned earth observation missions. In looking forward to what the objectives of earth observations from space are expected to be in the future, together with what technology is expected to enable, what the earth observing program will look like during the first part of the twenty-first century is discussed. It is concluded that a key part of this program will be long-term observations holistically viewing the earth system. Author

A86-49479* California Univ., Santa Barbara.

SUPPORT FOR GLOBAL SCIENCE - REMOTE SENSING'S CHALLENGE

J. E. ESTES and J. L. STAR (California, University, Santa Barbara) Geocarto International, no. 1, 1986, p. 3-14. refs
(Contract NASW-455)

Advances in remote sensing techniques are discussed. The benefits possible to remote sensing with the new Earth Observing System, which is composed of the Space Station and coorbiting and polar satellite platforms, are examined. Current changes in the remote sensing field, which involve a change from an industrial society to an informational society, force technology to high technology with high touch, short term to long term, centralized to decentralized, hierarchies to networks, and either/or to multiple option systems are studied. The explanatory and objective types of analyses for investigating biophysical, geochemical, and socioeconomic processes are described; the procedures include: morphometric, cause and effect, temporal and functional and ecological system analyses, inventory, mapping, monitoring, and modeling. I.F.

N86-31976# International Inst. for Aerial Survey and Earth Sciences, Enschede (Netherlands).

ACTIVITIES REPORT IN AEROSPACE SURVEY AND SPACE SCIENCES Annual Report, 1984

1984 38 p
(ETN-86-98042) Avail: NTIS HC A04/MF A01

Education and research programs in photogrammetry, aerial photography and remote sensing, cartography, land resource surveys and rural development, Earth resources surveys, urban survey, and human settlement analysis are described. ESA

N86-32510 National Aerospace Lab., Amsterdam (Netherlands). Spaceflight Div.

PROPOSAL FOR NLR ACTIVITIES IN THE TROPICAL EARTH RESOURCES SATELLITE (TERS) SYSTEM DEFINITION

H. F. A. ROEFS 1984 69 p
(Contract NIVR-1013)
(NLR-MEMO-RS-84-019-L; ETN-86-97780) Avail: Issuing Activity

Technical, work planning, and financial aspects of Dutch participation in the Tropical Earth Resources Satellite project are summarized. Mission requirements, data handling and processing, and satellite operations are emphasized. ESA

N86-32845# European Space Agency, Paris (France).

REMOTE SENSING APPLICATIONS IN CIVIL ENGINEERING

N. LONGDON, comp. Mar. 1985 107 p Postgraduate Summer School held in Dundee, Scotland, 19 Aug. - 8 Sep. 1984; sponsored by Science andEngineering Research Council, ESA, Council of Europe and European Association of Remote Sensing Labs.
(ESA-SP-216; ISSN-0379-6566; ETN-86-95251) Avail: NTIS HC A06/MF A01

The physical basis of remote sensing; data reception; ESA Earth observation programs; the UK National Remote sensing Center; digital image processing; space cartography; land use

applications of remote sensing; remote sensing for highway engineers; geological surveys for nuclear plant location; estuary observations; snow and ice monitoring; and coastal zone monitoring were discussed.
ESA

N86-32849# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
ESA AND ITS EARTH OBSERVATION PROGRAMS
J. N. DEVILLIERS *In its* Remote Sensing Applications in Civil Engineering p 19-28 Mar. 1985
Avail: NTIS HC A06/MF A01

The ESA Earth Observation Programs in meteorology (Meteosat) precise time transfer (LASSO), remote sensing of the oceans (ERS-1), and cartographic mapping from Spacelab are described. Reception, processing and distribution of satellite remote sensing data are outlined. The requirements for advanced satellite missions in land observation and solid Earth physics, and studies undertaken to define and determine the feasibility of such missions are summarized. ESA

N86-32850# Royal Aircraft Establishment, Farnborough (England). National Remote Sensing Centre.
THE UK NATIONAL REMOTE SENSING CENTRE
P. VASS and M. ELKINGTON *In* ESA Remote Sensing Applications in Civil Engineering p 29-33 Mar. 1985
Avail: NTIS HC A06/MF A01

The UK National Remote Sensing Centre, including its organization and terms of reference; data reception facilities; data services and products; image processing facilities and major operations; and main fields of application are described. Domains covered include: coastal processes; oceanography and marine applications; land applications; information handling techniques; education and training; hydrology and water resources; and geological applications. Satellites and sensors, including ERS-1, and geographic information systems are discussed. ESA

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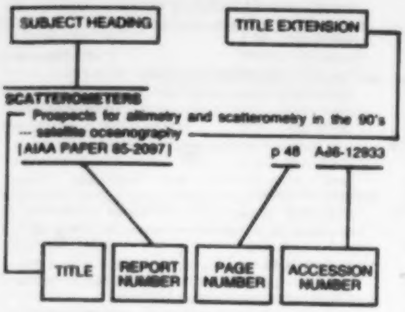

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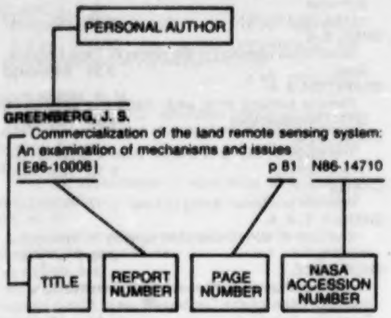

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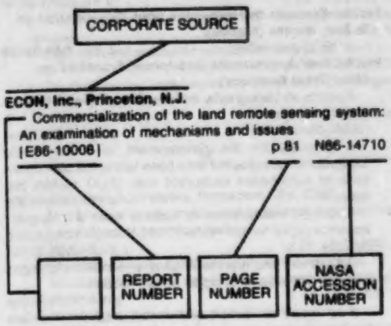
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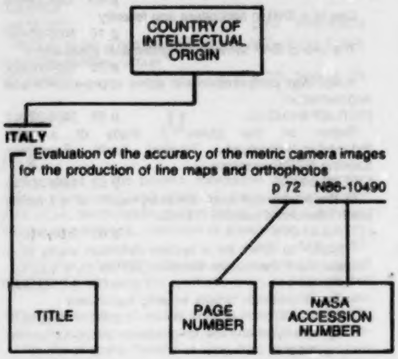
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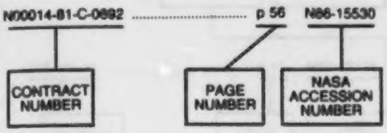

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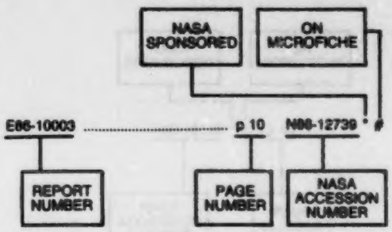

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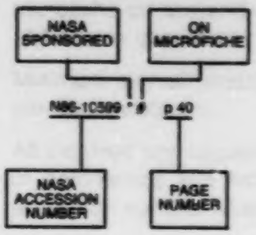

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